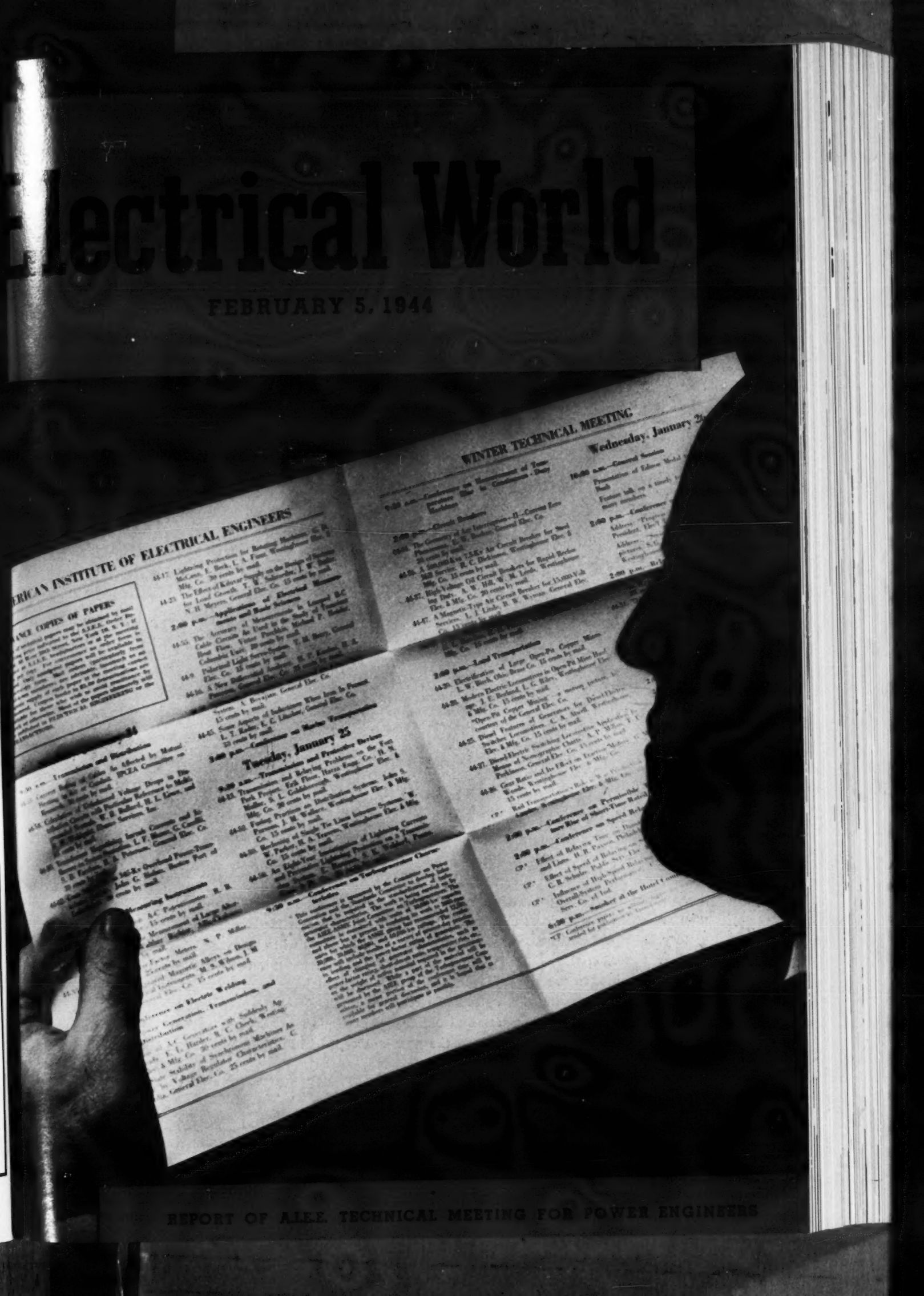
Electrical World
FEBRUARY 5, 1944
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
ADVANCE COPIES OF PAPERS
WINTER TECHNICAL MEETING
Wednesday, January 26
Tuesday, January 25
REPORT OF A.I.E.E. TECHNICAL MEETING FOR POWER ENGINEERS

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. . . through the war and beyond!

The start of the new year finds instrument headquarters still *busy at it* in the final drive for victory. Dependable WESTON instruments, in all familiar types, continue flowing in unprecedented quantities to every battle front. *In new types, too;* for all during this period of stress WESTON development laboratories also have *led the way* . . . continually meeting the new measurement problems of this mechanized war. Thus when instrument priorities are relaxed, WESTONS will continue as industry's *standards* for all measurement needs. For, *new* measurement tools as well as *old* will be available in their most *trustworthy form* . . . here at instrument headquarters. Weston Electrical Instrument Corp., 616 Frelinghuysen Ave., Newark 5, N. J.

Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

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Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters...Aircraft Instruments... Electric Tachometers...Dial Thermometers.

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Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 70 YEARS

February 5, 1944

Vol. 121, No. 6

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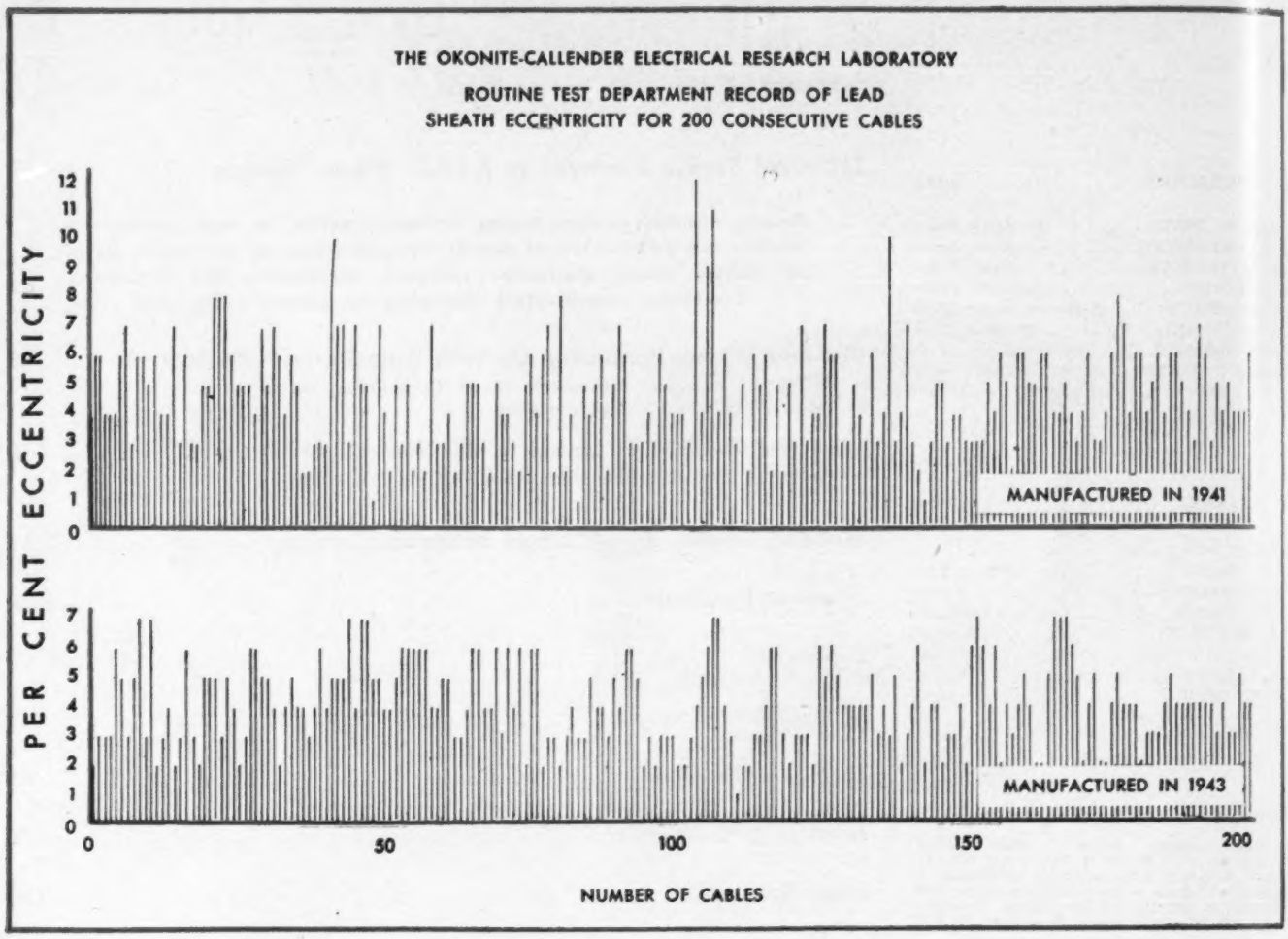
400 CABLES-

TELL THE STORY OF IMPROVED LEAD SHEATH THICKNESS CONTROL!



The improvement graphically shown above has taken place over a period of only 2 years. These bar charts each represent lead sheath eccentricity measurements on a group of 200 consecutive lengths of oil-impregnated paper-insulated cable made at the beginning and end of this period.

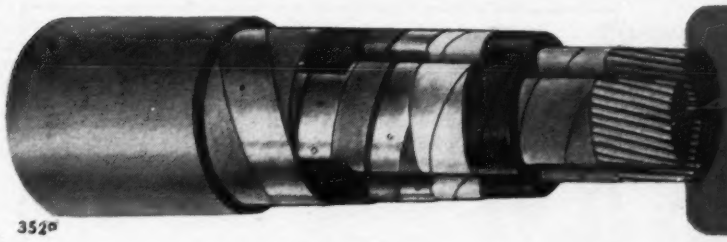
In 1941, although every one of the 200 cables was well within the A.E.I.C. specification limits*, 5% of the lengths exceeded 7% in eccentricity. At that time this was considered a remarkable record. But in the latest test *not a single one of the 200 consecutive lengths had a lead sheath eccentricity of more than 7%.*

There are 3 reasons for this noteworthy accomplishment:

(1) Rigid, self-imposed Okonite-Callender factory specifications for lead sheathing.
(2) Consistent use of the Okonite-Callender electric eccentricity gauge during the extrusion process.
(3) Close cooperation between Research and Production departments.

Through persistent Okonite-Callender Research many other improvements in manufacturing control make it possible to obtain paper cables that have longer life than any of pre-war design. Our engineers can tell you more about these improvements. The Okonite-Callender Cable Co., Inc., Passaic, New Jersey.

** The A.E.I.C. specifications require actual physical measurements with a micrometer and limit the eccentricity of lead sheaths to a maximum of 18%.*



352ª

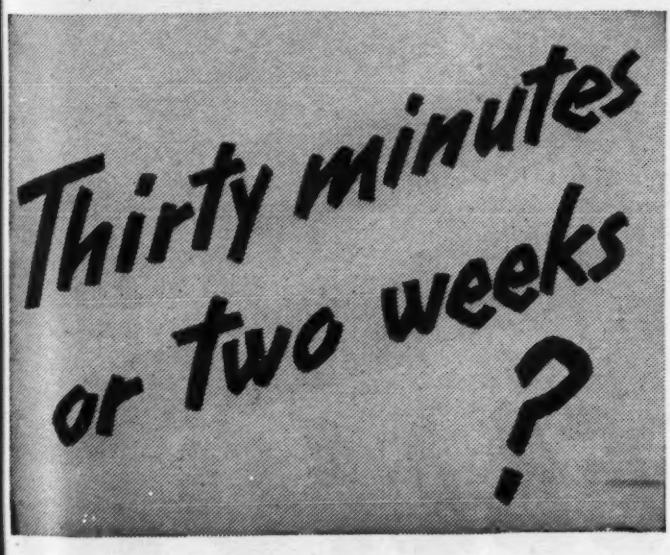
OKONITE-CALLENDER
PAPER INSULATED POWER CABLES

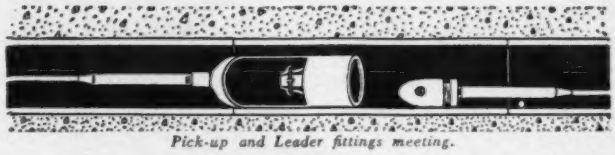
UTILITIES have found that one gang, with Electroline Steel Duct-Rodding Equipment, can make a half-hour job out of one that formerly took two gangs two weeks with old-style equipment!

In consequence, they have made amazing savings in labor cost alone. Add to this lower first cost, the lower handling cost, and longer life . . . then you have their reason for adopting Electroline's speedy, economical Duct-Rodding Equipment.

The construction is simple and trouble-free, yet affords the outstanding advantages of easy, efficient rodding and great durability in service.

You can turn days into minutes, too—by speeding up installation and cutting costs with Electroline Duct-Rodding Equipment. Get full details and prices . . . write for a copy of descriptive Bulletin 939.



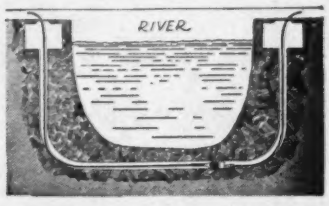


Pick-up and Leader fittings meeting.

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

Below, Leader locked in Pick-up for either push or pull.

PATENT APPLIED FOR



Electroline Company

4121 SOUTH LASALLE STREET
CHICAGO, ILLINOIS

Five like these for Union Electric

This prominent mid-west utility was able to speed up its development under pressure of war needs, and get its new Venice No. 2 station on the line in time to give maximum assistance to the war effort.

In this station, Elliott motors drive the boiler-feed pumps. These motors are of the large, two-pole specially constructed drip-proof squirrel-cage induction type which are rapidly getting favorable notice in many nationally famous plants. Three of these motors (illustrated) are 800 hp and two are 1750 hp. All operate at 3600 rpm. They are equipped with an integral pressure lubricating system.

The engineering and construction of Venice No. 2 station was under the supervision of Stone and Webster Engineering Corporation of Boston.

Have you a drive that calls for motors of this calibre? Discuss it with Elliott.

They're those big high-speed two-pole induction

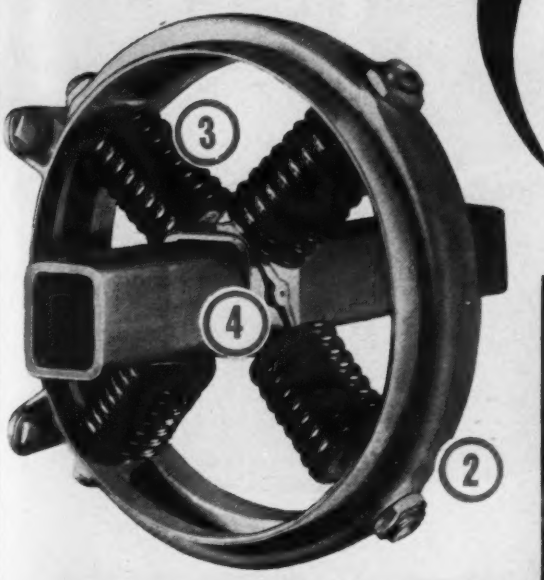
ELLIOTT COMPANY
Electric Power Department, **RIDGWAY, PA.**
DISTRICT OFFICES IN PRINCIPAL CITIES

MOTORS by ELLIOTT

L-747

CHECK the FACTS

1. Sealed, dust proof, individual bus housing provides phase isolation and prevents interphase short circuit. Removable covers in unit sections simplify routine inspection.
2. Supporting ring frames equalize all stresses. Can be mounted in any position.
3. With interchangeable insulator units always in compression, porcelain is used to its best advantage.
4. The same conductor support collar is used for both fixed and expansion slide position. Conductor can be square, round, channel or bar, insulated or bare.



Suitable for any voltage or current

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ISOLATED PHASE BUS

The Check List

- CONDUCTOR SUPPORT CLAMPS AND FITTIN
- DISCONNECTING SWITCH INDOOR AND OUTDOOR
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- INTERRUPTER SWITCH
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATIN MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSE ISOLATED PHASE HEAVY DUTY BUS
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SECTIONALIZING EQUIPMENT
- METAL CUBICLE
- TESTING DEVICE

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

IN CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

THE KIND OF STRENGTH THAT COUNTS BECAUSE YOU CAN COUNT ON IT!

...O-B's minimum strength rating of Suspension Insulators

Electrically, all good makes of suspension insulators are highly standardized. The "frontier" of insulator development today is along lines of mechanical strength. The problem is not one of brute strength so much as it is one of consistent, reliable strength...Higher mechanical factors introduce the greater possibility of deviation. Average strength--the basis on which such insulators were rated--covered this range of variation, and left the transmission engineer in the dark with no specific value to build on. He usually called for over-strength and paid a premium for it, just to be sure of getting what he needed...O-B's superior manufacturing methods enabled it to be the first to offer suspension insulators rated on the basis of specific *minimum strength*--the starting point of any good engineering design. This value is permanently cast on every cap. It is a definite rating of each individual insulator. Look for it. Get the kind of strength that *counts*, because you can *count* on it!

Ohio Brass

MANSFIELD, OHIO

2467-H

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

Can you think of 7 better reasons for installing MILLER Fluorescent now?

Here are provable facts—facts that have caused war industry to insist upon MILLER 50 & 100 FOOT CANDLER Continuous Fluorescent Lighting Systems . . .

1 NEW, IMPROVED DESIGN of the Miller Continuous Wireway Flourescent Lighting System, constructed to comply with wartime regulations for conservation of critical materials —the same as introduced in 1939.

2 RUGGED LIGHTWEIGHT EQUIPMENT —rigid compact channels and Masonite reflectors—no reduction in lighting efficiency.

3 EXPOSED BALLAST for coolest possible operation—all wiring concealed but accessible upon removal of lightweight reflector.

4 LAMPHOLDERS rigidly mounted back-to-back for mutual stiffening and maintenance of spacing. Miller patented lamp lock also available, minimizing danger of falling lamps.

5 LOW INSTALLATION COST — savings of 30-50% again possible by use of 8 foot and 10 foot rugged double length channels—one suspension per channel section—simplified wiring in continuous rows.

6 SIMPLIFIED MAINTENANCE—ballasts, lampholders and starters readily accessible — starters located between lamps.

7 UNIFORM ILLUMINATION—the 30 to 50 or more footcandles required for war production easily obtainable from practical row spacings.

We suggest you write or wire today for complete information.

THE MILLER COMPANY • MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent
Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners
and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass
in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Materiel

MILLER
SINCE 1844

★ NUMBER 5 IN A SERIES, TRACING FIFTEEN YEARS OF KELLETT ROTARY WING PROGRESS ★

A pre-war U.S.A.A.F. Kellett* serving as observer in U. S. Army tank maneuvers.

Eastern Air Line's Kellett flew mail for a full year from Philadelphia's Post Office roof.

Daily flights on border patrol are dramatically demonstrating Kellett serviceability.

. . . and Kellett is looking to a future of expanding service to the nation.

Pioneering Peacetime Progress

THE above photograph of a Kellett rotary wing aircraft performing in tank maneuvers was taken almost six years ago!

For almost a decade *before* that, Kellett engineers were developing and manufacturing successful rotary wing ships. And each year *since*, Kellett has continued to pioneer progress in the science. With each turn of the calendar have come important advances, as continuous research and in-the-air accomplishments have added to the Kellett organization's total experience.

While war continues, all Kellett production is concentrated on military applications—important fighter and bomber parts, as well as rotary wing aircraft. But when peace comes, our expanding staff of forward-thinking engineers looks to opportunities for Kelletts to save time and cut costs in a wide variety of peacetime applications: the convenient inspection and servicing of cross country electric lines and oil pipe lines; their use as mail and passenger shuttle craft; services to rural communities; the patrolling of forests and borders; spraying crops and trees. Kellett Aircraft Corporation, Upper Darby (Philadelphia), Pennsylvania.

*Current Kellett models, developed in cooperation with the United States Army Air Forces, may not be illustrated as yet.

KELLETT

OLDEST ROTARY WING AIRCRAFT MANUFACTURING COMPANY

STEP UP

...Motor and Lighting Performance!

THAT BANK of three Allis-Chalmers Dry-Type Transformers, below, assures *better* voltage regulation, *lower* line losses in a large west coast shipyard.

The units are installed *right next to* the equipment they serve, yet they're up . . . *out of the way.* A long run of heavy secondary copper was saved. Man-hours and money were saved . . . because fireproof vaults weren't needed. There is no insulating liquid to test, filter or change . . . saving on maintenance. And because these drip-free units go up anywhere — on posts, beams, platforms, etc. — valuable floor space is saved!

Allis-Chalmers Dry-Type Transformers are ready for quick shipment *now.* For details, see our nearby district office. Or write, ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

A 1692

These Units Ready for Quick Shipment—Now!

CHECK THESE TRANSFORMER FEATURES:

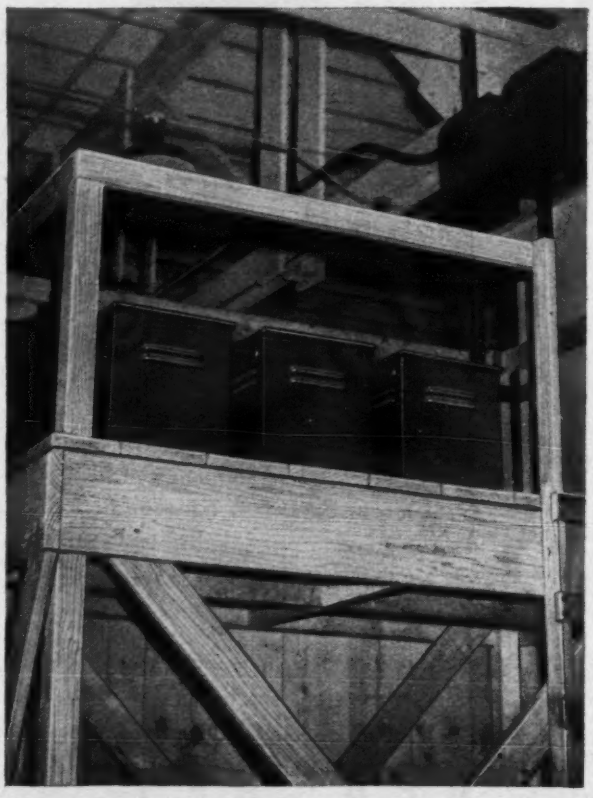
Smaller, Adaptable Size — permitting quick, easy changeover.

Easy-To-Get-At connections and knockouts; fast installation.

Windings Separated by solid insulation — meet safety requirements for inside buildings.

Coils Heavily Impregnated — rendering windings resistant to moisture.

Wide Range of Sizes — 1½ to 500 kva, single and 3-phase, with incoming voltages up to 15,000 v.



ALLIS-CHALMERS DRY TYPE TRANSFORMERS

K&M Ebonized Asbestos

—THE SUPERIOR ELECTRICAL INSULATION

K&M Ebonized Asbestos was specially developed to meet the exacting demands of the electrical industry. Consequently, it has proved most satisfactory as a mounting for switchboards, panels, bus bar supports and testing tables.

K&M Ebonized Asbestos has extraordinary physical strength, as it is asbestos fibre and binding cement, molded into sheets under great pressure. It has unusually high dielectric strength because it is impregnated with a special insulating compound. It is unaffected by oil or moisture—it will not crack, shrink or bulge—and it actually gets tougher with time.

Until recently, the war needs of fighting craft and vital industries have taken all our production. Now, however, with added productive facilities we can supply you with K&M Ebonized Asbestos again—in $\frac{1}{8}$ to 4-inch thicknesses, in "standard" or special "panel" finish.

K&M Ebonized Asbestos meets the technical requirements of the Underwriters Laboratories, Inc., when built into an assembled unit.

* * *

Nature made asbestos;
Keasbey & Mattison, America's asbestos pioneer,
has made it serve mankind . . . since 1873

KEASBEY & MATTISON
COMPANY, AMBLER, PENNSYLVANIA

ARMY E NAVY
K&M best in asbestos

★ Our Ambler plants proudly fly the Army-Navy "E" flag—an honor awarded K&M employees "for outstanding production of war materials."

100H UNIVERSAL MATTHEWS FUSE LINKS

COVERED BY PATENTS 1,797,850, 2,067,577 AND PATENTS PENDING

BEST FOR CASCADING

Die Crimped
1 to 20 amps. inclusive are equipped with repulsion springs.
Die Crimped
Lead coated rope copper flexible tail. Won't corrode in sulphurous atmospheres.
Each link contained in strong paper tube.
25 links packed in each strong paper can.

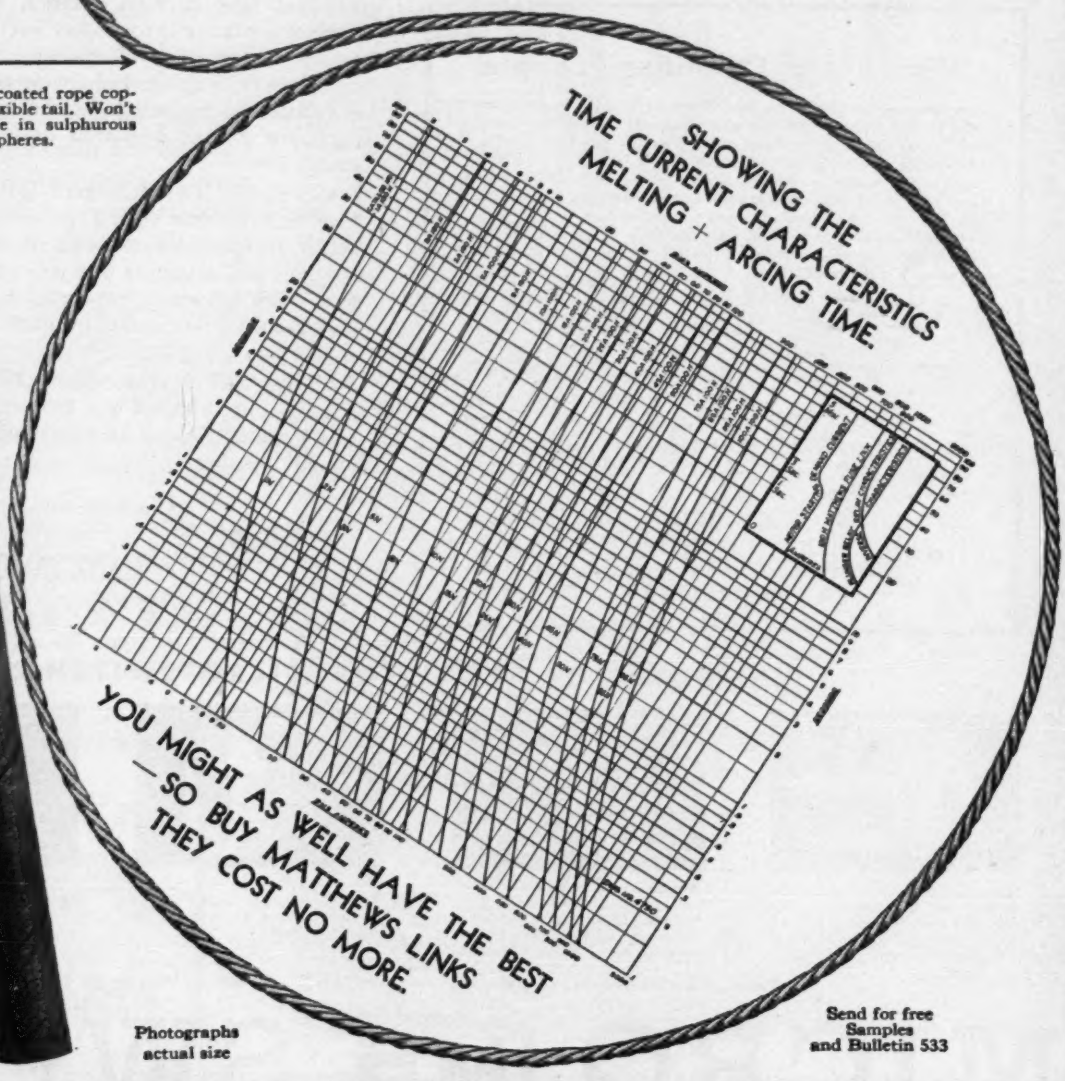
One user of 100-H Links makes it a practice before each lightning season to re-fuse all important cutouts. They claim that this gets rid of all overstressed links and prevents a lot of unnecessary outages and more than justifies its cost. A good way for you to find out that 100-H Matthews Fuse Links are better is to re-fuse some of your more important circuits now and watch the results through the next lightning season.

No solder used in them. Fusing elements are of hard drawn copper. They are mechanically stronger.

Their accuracy is guaranteed to be within 10% + or —.

In addition to the 17 sizes shown on the curves below they are made in ½, 125, 150, 175 and 200 ampere ratings.

Photographs actual size. 100-H shown. 50-H same excepting that it is 13 inches overall instead of 26 inches.


SHOWING THE TIME CURRENT CHARACTERISTICS MELTING + ARCING TIME.
YOU MIGHT AS WELL HAVE THE BEST —SO BUY MATTHEWS LINKS THEY COST NO MORE.

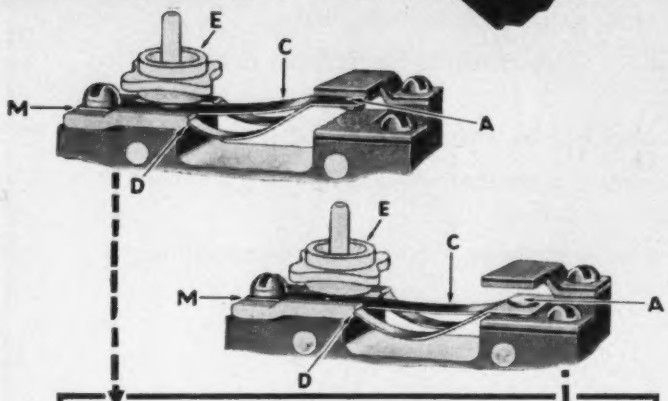
Photographs actual size

Send for free Samples and Bulletin 533

W. N. MATTHEWS CORPORATION, ST. LOUIS, U. S. A.

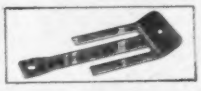
Why MICRO SWITCH

PROVIDES A LONG SNAP-ACTION LIFE



Micro Switch Operating Principle

The operating principle of the Micro Switch as illustrated here is simple and fundamentally correct. The long member of the one-piece spring "C" is supported as a cantilever at "M". The two shorter compression members of the spring rest in specially shaped (patented) V's. When the plunger "E" deforms the long tension member, the cantilever force overcomes the vertical force supplied by the compression members and the free end of the spring "A" snaps the contact from one stop to the other with lightning-fast speed. Snap action in the reverse direction occurs when the deformation of the tension members of the spring by plunger "E" is removed.



This one-piece beryllium copper spring is heat treated to provide the high fatigue resistance necessary to insure a minimum of 5,000,000 trouble-free mechanical operations, at full overtravel.

The rivet type contact is of superfine silver 99.95% pure.

The operating plunger is a highly polished, hard, stainless steel pin molded into an accurate Bakelite head. This head is so shaped that it cannot rotate, hence bears on the switch spring at the same point through millions of operations.

Micro Switch provides lightning-fast, snap-action control of electric circuits with reliable and positive operation accurately repeated over millions of cycles.

This performance is made possible by use of the unique, field tested, and proven operating principles of the Micro Switch. The snap motion of the Micro Switch contact is in the same direction as that of the operating plunger. There are no reverse bends in the Micro Switch spring, and there is no life-limiting "oil can" action.

The experience of utility engineers with millions of Micro Switches in a great variety of applications has shown performance ability and operating characteristics never before found in snap-action switches.

Its small size, its high electrical rating, its ability to operate satisfactorily for millions of operations on minute movement and force differentials, its availability in various types of housings and a wide range of actuators . . . have made Micro Switch the choice of production engineers for precise operation of many types of plant equipment.

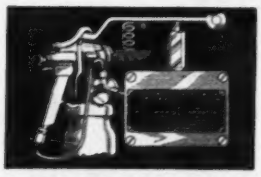
Micro Switch is Underwriters' listed and rated at 1200 V.A., at 125 to 460 volts a.c. Capacity on d.c. loads depends on load characteristics. A wide variety of basic switches and actuators provides characteristics varying from high vibration resistance to sensitivity requiring only 2-1000 ounce inches of operating energy.

Micro Switch Handbook-Catalog No. 60 will give you complete details as to electrical characteristics, construction, applications and dimensions. If you happen to be specializing in aircraft equipment, also send for Handbook Catalog No. 70.

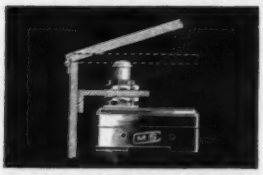
Micro Switch Corporation, Freeport, Ill.
Branches: 43 E. Ohio St., Chicago (11) • 4900 Euclid Ave., Cleveland (3) • 11 Park Pl., New York City (7) • 1709 W. 8th St., Los Angeles (14) • Sales & Engineering Offices: Boston - Hartford

BUY ALL THE BONDS YOU CAN

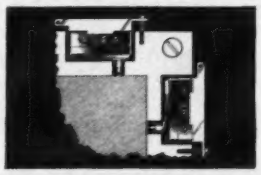
HUNDREDS OF SPOTS FOR MICRO SWITCHES



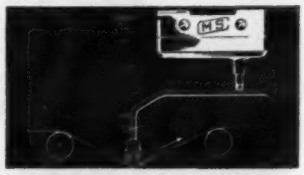
An explosion-proof Micro Switch is used with a spray gun to cut off the ventilating system of the spray booth automatically when the gun is hung up.



Micro Switches with push button actuators are used as safety switches on high tension cabinet doors. A normally open switch breaks circuit as door is opened.



Two Micro Switches with spring type plungers are used to insure correct position of material in jigs and fixtures.



Spring plunger Micro Switches serve as break indicators in textile and paper mills.

The trademark MICRO SWITCH is our property and identifies switches made by Micro Switch Corporation

© 1944

MICRO MS SWITCH

TRADE MARK

Made Only By Micro Switch Corporation . . . Freeport, Illinois, U. S. A.

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

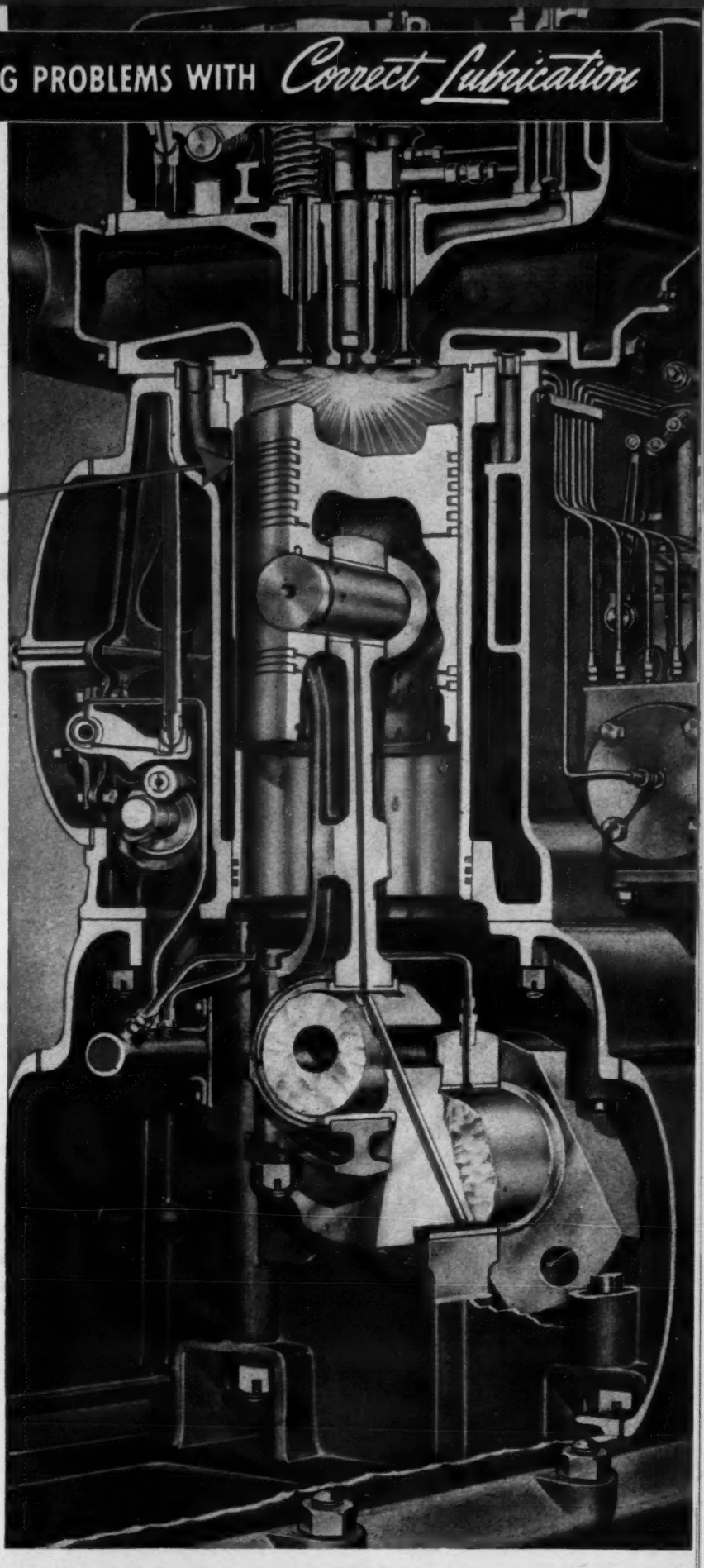
HOW TO SOLVE OPERATING PROBLEMS WITH *Correct Lubrication*

GET

Full Power

WITH

Free Rings!



IN DIESEL ENGINES like this, a vital lubrication problem is to keep rings, pistons, and valves free from hard carbon deposits.

This calls for special oils that will not only resist the formation of deposits but will make certain that any deposits which do form are soft and fluffy. These oils also must provide strong films (even when squeezed to microscopic thinness) to protect against wear.

Gargoyle D. T. E. Oils are specifically designed to meet these exacting requirements. They're made from specially selected crudes, and refined to stand up under the highest temperatures and pressures of Diesel operation.

•

Socony-Vacuum Oil Co., Inc.

Standard Oil of N. Y. Div., White Star Div., Lubrite Div., Chicago Div., White Eagle Div., Wadhams Div., Magnolia Petroleum Co., General Petroleum Corporation of California.

GARGOYLE

Lubricants

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

CALL IN SOCONY-VACUUM

Use new Buying Data

TO REDUCE SELECTION AND ORDERING TIME

1/2

simplified

FOR QUICKER SELECTION . . .

EASIER ORDERING . . .

QUICKER DELIVERY . . .

When you need motors and control, consult your new Westinghouse Buying Data. It will help you to select and purchase the proper equipment—in ½ *the time.*

Data, as presented, is striking in its newness. It's easier to read, easier to understand, and easier to use than any offered previously by any manufacturer.

To fit widely varying requirements, this radically new Buying Data is available in two forms:

Motor and Control Loose-Leaf Book. This is for the use of large-scale purchasers and is "tailored" to meet the needs of the individual buyer. Pricing data is always kept up to date by the issuance of new price supplements.

Bound books are suitable for use of the majority of motor and control buyers. They contain prices (correct at time of issue and satisfactory for estimating purposes throughout the books' life), dimensions, application data and descriptions. Books include:

"Motor Buying Data" covering popular types and ratings of motors (up to 100 hp), Gearmotors and M-G sets.

"Control Buying Data" listing a wide variety of controllers and accessories for direct current, single-phase, squirrel-cage, wound rotor motors.

J-90499

HERE'S HOW TO GET THIS NEW BUYING DATA

If you are a buyer of Motors and Control, chances are you have already received this new data by mail.

However, if you have not received your copy, write, wire or phone your nearest Westinghouse district office (requests will be filled through district offices only—no mailings from Westinghouse Headquarters at East Pittsburgh). Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

MOTORS AND CONTROL

Nicopress REINFORCING SLEEVES

for strengthening damaged Copperweld-copper conductors

Nicopress Reinforcing Sleeves offer an ideal means of strengthening Copperweld-copper conductors at points where one or two of the copper wires have been damaged. These sleeves are split the full length and may be slipped over the damaged section and compressed with the same Nicopress Tool used in making the regular line splice.

The National Telephone Supply Company

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr.—N. SLATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

THE NATIONAL TELEPHONE SUPPLY COMPANY

Electric Cables by Simplex

for Power, Communication and Control

With "synthetic rubber" insulation which, during the past two years has gradually taken the place of natural rubber compounds. Performance records already promise an important future for Simplex "synthetic rubber" insulation for power, communication and control cables.

Subject to W.P.B. regulations

With varnished cambric insulation for high voltage over short distances. Particularly suited for station or power house wiring and where operating temperature is high. Varnished cambric insulated cables may be covered with weatherproof or flameproof braids, lead sheath or steel armor.

With impregnated paper insulation for transmission of large blocks of power at higher voltages. Paper insulated cables are lead sheathed to keep moisture out. Best results can be obtained when cables are specially designed for the work they are to do.

If your postwar plans call for new cables — submarine, underground or aerial — for repairs, replacements or expansion, we shall be pleased to tell you what we can do for you now to help you prepare for the change from war work to "business as usual." It will be greatly to your advantage if you act quickly when the time comes.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

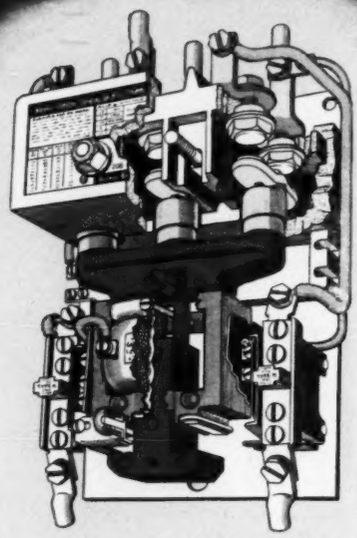
Simplex

WIRES and CABLES

WARTIME HAS NO TIME for CONTACT MAINTENANCE

Copper contact before and after 50,000 operation life test. It was necessary to replace contact.

A-B silver alloy contact before and after same test. Contacts were still good for thousands of operations.



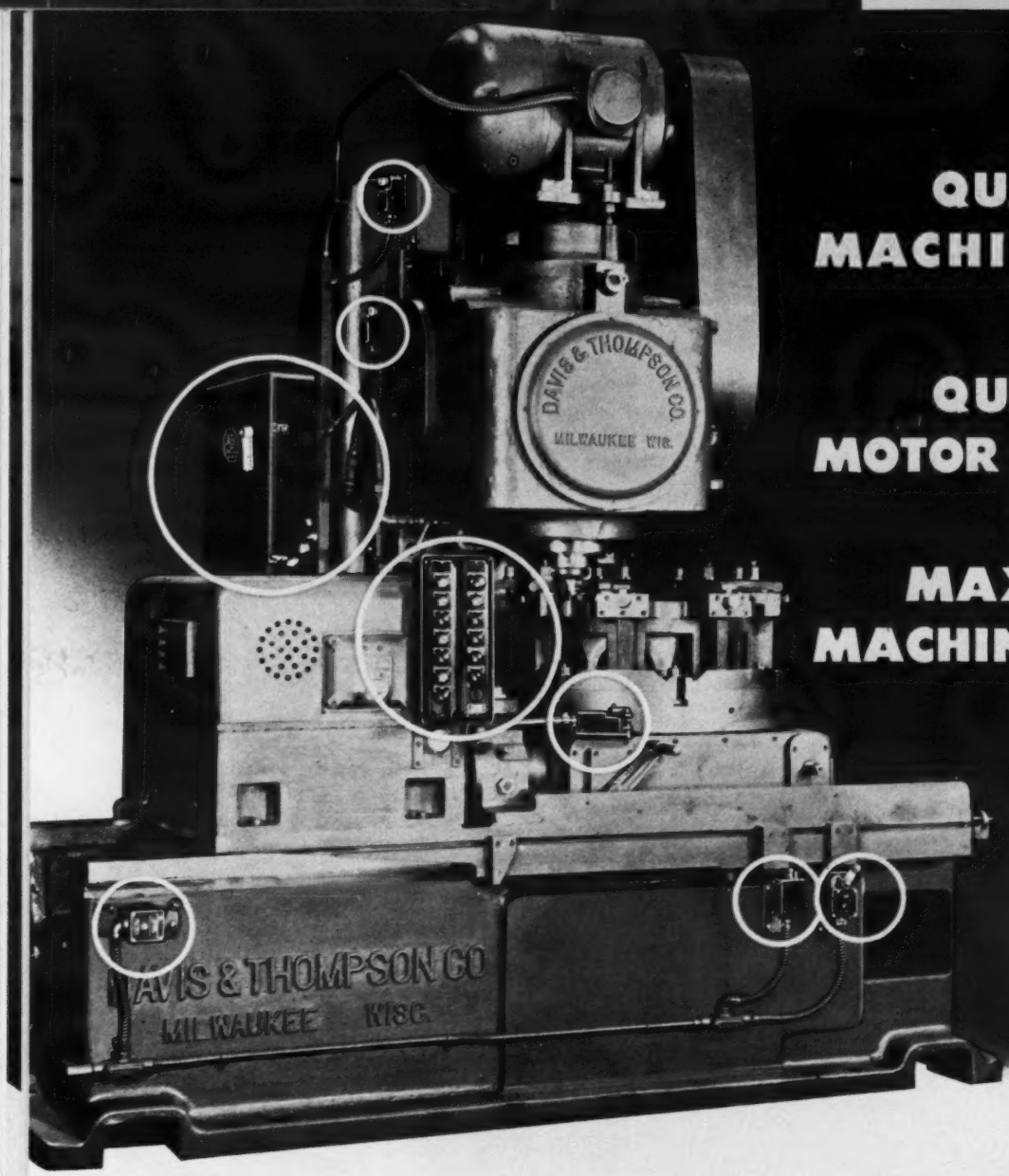
The solenoid plunger—shown in red—is the only moving part of the A-B starter.

War plant machinery needs the freedom from contact maintenance that is part of Allen-Bradley trouble-free motor controls. A-B solenoid starters have patented, double break, silver alloy contacts which are good for millions of operations. They never need cleaning, dressing, or filing. The oxide which may form on them is a good electrical conductor and therefore low contact resistance is always assured. When you're making replacements or buying new motorized equipment, be sure to specify trouble-free Allen-Bradley motor controls. Write today for Bulletin 709.

A-B Quality

ALLEN-BRADLEY
SOLENOID MOTOR STARTERS

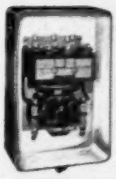
QUALITY



QUALITY MACHINE TOOLS + QUALITY MOTOR CONTROLS = MAXIMUM MACHINE OUTPUT

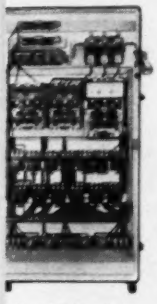
Relay

Limit Switch and Precision Limit Switch



Across-the-line starter

Push Buttons



Special Control Panel

Your guarantee of highest efficiency from operator and machine is to use Allen-Bradley controls for automatic sequence operations. Oscillograph tests show that A-B solenoid controls close in short, uniform pick-up intervals which assure consistent switching performance. No other magnetic controls provide such split-cycle accuracy which saves time and increases the production of your machine.

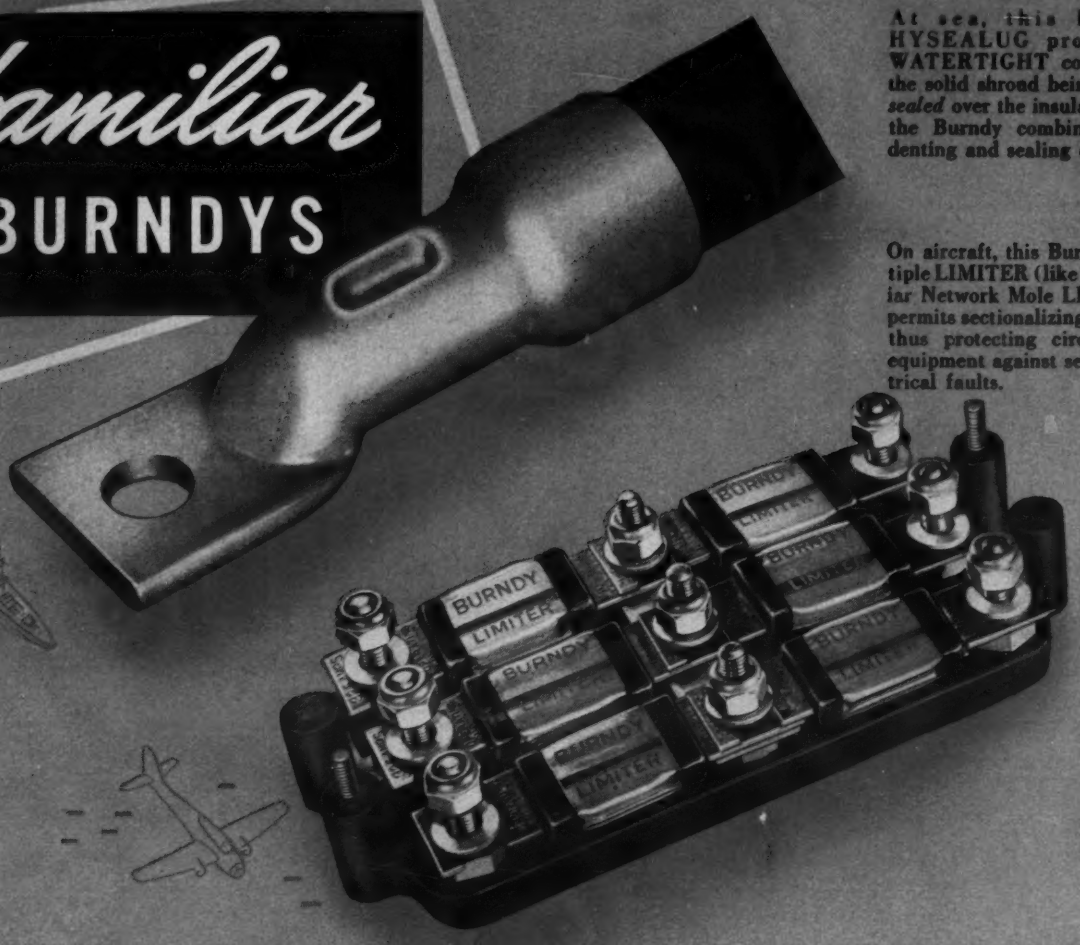
There's no time lost for maintenance either. A-B double break, silver alloy contacts never need filing, cleaning, or dressing. With only one moving part, there's nothing to get out of order. A-B controls are an asset to any machine.

Allen-Bradley Company, 1316 S. Second St.
Milwaukee 4, Wis.

ALLEN-BRADLEY

AUTOMATIC MOTOR CONTROL

familiar BURNDYS



At sea, this Burndy HYSEALUG provides a WATERTIGHT connection; the solid shroud being readily *sealed* over the insulation with the Burndy combination indenting and sealing die.

On aircraft, this Burndy Multiple LIMITER (like the familiar Network Mole LIMITER) permits sectionalizing circuits; thus protecting circuits and equipment against severe electrical faults.

. . . *dressed for War*

To the utility industry, America owes much for the outstanding efficiency of its electrified fighting equipment. Basic utility designs for networks and electrical components are in evidence everywhere . . . a tribute to the engineering skill and foresight of the utility engineer.

Even for connectors, Burndy has leaned heavily on its *utility background* in designing efficient connectors to meet all the arduous requirements of this mechanized war.

Headquarters for CONNECTORS

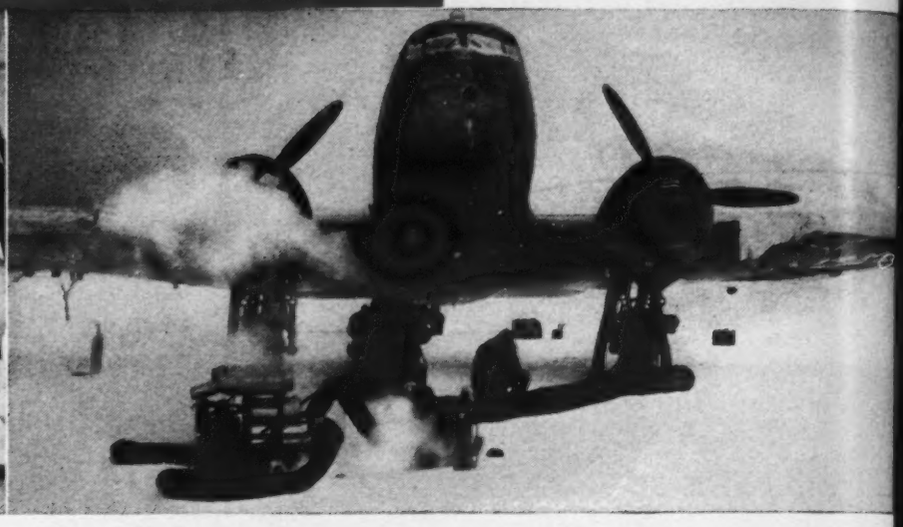
Burndy

BURNDY ENGINEERING CO., INC.
107 EASTERN BOULEVARD, NEW YORK 54, N. Y.
IN CANADA: *Canadian Line Materials Limited, Toronto 13*

LIFE ON THE PLASTICS NEWSFRONT

LITERATURE ON PLASTICS AVAILABLE ON REQUEST

A new manual, "MELMAC Molding Compounds," is now available to designers, engineers, and others interested in the fabrication and use of plastics. A similar booklet, "BEETLE Molding Materials," will also be sent on request. Each contains a complete summary of the latest information and technical data on molding methods, applications, design instructions and property charts for Cyanamid molding materials currently available.

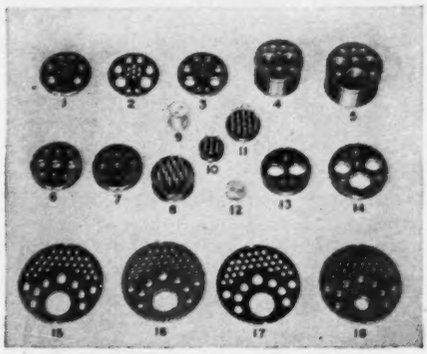


WHY MELMAC PLASTICS FOR EXTREMES OF SERVICE CONDITIONS

Mineral-filled MELMAC* Molding Material, widely employed for production of automotive and aircraft ignition assembly parts, has the outstanding advantage of maintaining its excellent dielectric properties under extremes of temperature and humidity.

Tested not only in the modern laboratory "torture chamber" like that shown at left above, where flight conditions at 40,000 ft. are simulated, but also under extreme field service conditions such as the engine "defrosting" operation illustrated at right above, MELMAC parts have conclusively demonstrated their superiority over materials previously used.

These unusual electrical properties suggest the use of MELMAC plastic parts for other electrical and industrial applications where high arc resistance and good dielectric strength are required. If your plans include the use of plastic parts for circuit breakers, terminal blocks, connectors, switch plates or similar equipment, investigate MELMAC's advantages. Your inquiry will receive prompt attention.



(*Above*) **INSERTS FOR MULTIPLE CONTACT** cable connectors for aircraft electrical circuits are products of the Cannon Electric Development Company. Molded of MELMAC because of its high arc resistance (ASTM Avge. 130 Sec.), dielectric strength (430 Volts/Mil.), and heat resistance (300°F.). Parts shown above include socket front insulators, locking disc insulators, rear socket insulators, socket inserts, front and rear molded insulators, insert assemblies, and insulators with pin inserts.

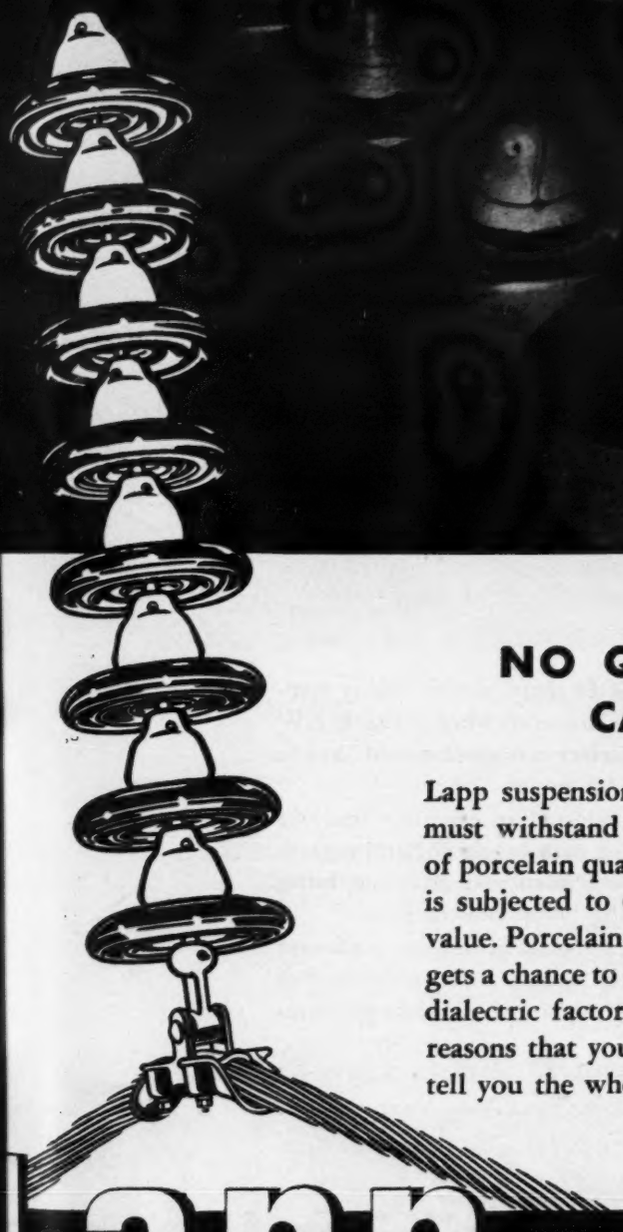
(*Above*) **DIELECTRIC PROPERTIES of BEETLE*** a the availability of this material in white a pastel colors are reasons for its increas use for fluorescent tube sockets and oth molded parts for modern lighting equi ment. In translucent form, BEETLE is a widely used for molded plastic reflec bowls for both commercial and portab lighting designs. High light transmiss and excellent light diffusion properties ma this light-weight, shatter-resistant plastic ideal material for many lighting nee

*Reg. U. S. Pat.

AMERICAN CYANAMID COMPANY · PLASTICS DIVISION · 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

CYANAMID PLASTICS

BEETLE · MELMAC · URAC · MELURAC · LAMINAC



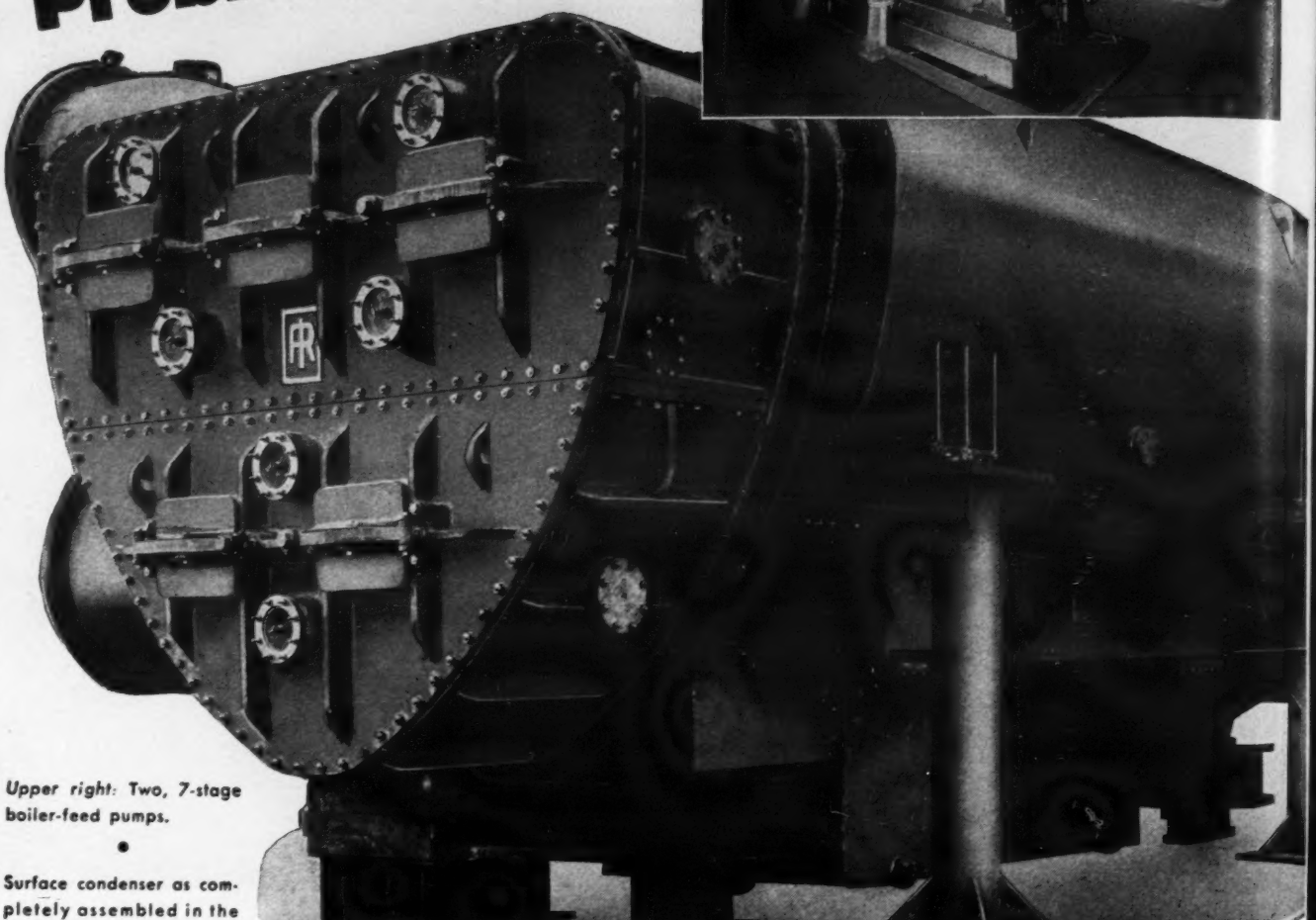
NO QUESTIONABLE PORCELAIN CAN SURVIVE THIS TEST

Lapp suspension insulator units, before being approved for shipment, must withstand the Overpotential Test, the industry's most severe test of porcelain quality. Its rim immersed in oil to prevent flashover, the unit is subjected to 60 cycle current at voltage higher than rated flashover value. Porcelain not up to the Lapp standard, punctures in this test, never gets a chance to fail on your lines. Units that survive are assured a definite dialectric factor of safety. The Overpotential Test is one of the many reasons that you do better with Lapp insulators on your lines. May we tell you the whole story? Lapp Insulator Co., Inc., LeRoy, N. Y.

Lapp

Better Porcelain • Better Insulators

A TOUGH Problem Solved



Upper right: Two, 7-stage boiler-feed pumps.

•

Surface condenser as completely assembled in the Ingersoll-Rand plant.

Highly corrosive circulating water caused a large New England electric utility company to use jet condensers on their earlier installations. However, when a 40,000 KW extension was proposed, it was evident that a suitable surface condenser would have to be used to provide pure feed water for a modern 1350 psi. boiler.

The electric company and its consulting engineers conducted an extensive study in order to determine the best tube material. They consulted with Ingersoll-Rand regarding the design and construction of the condensing plant, particular attention being given to the water-box design, tube ends, and circulating pump construction.

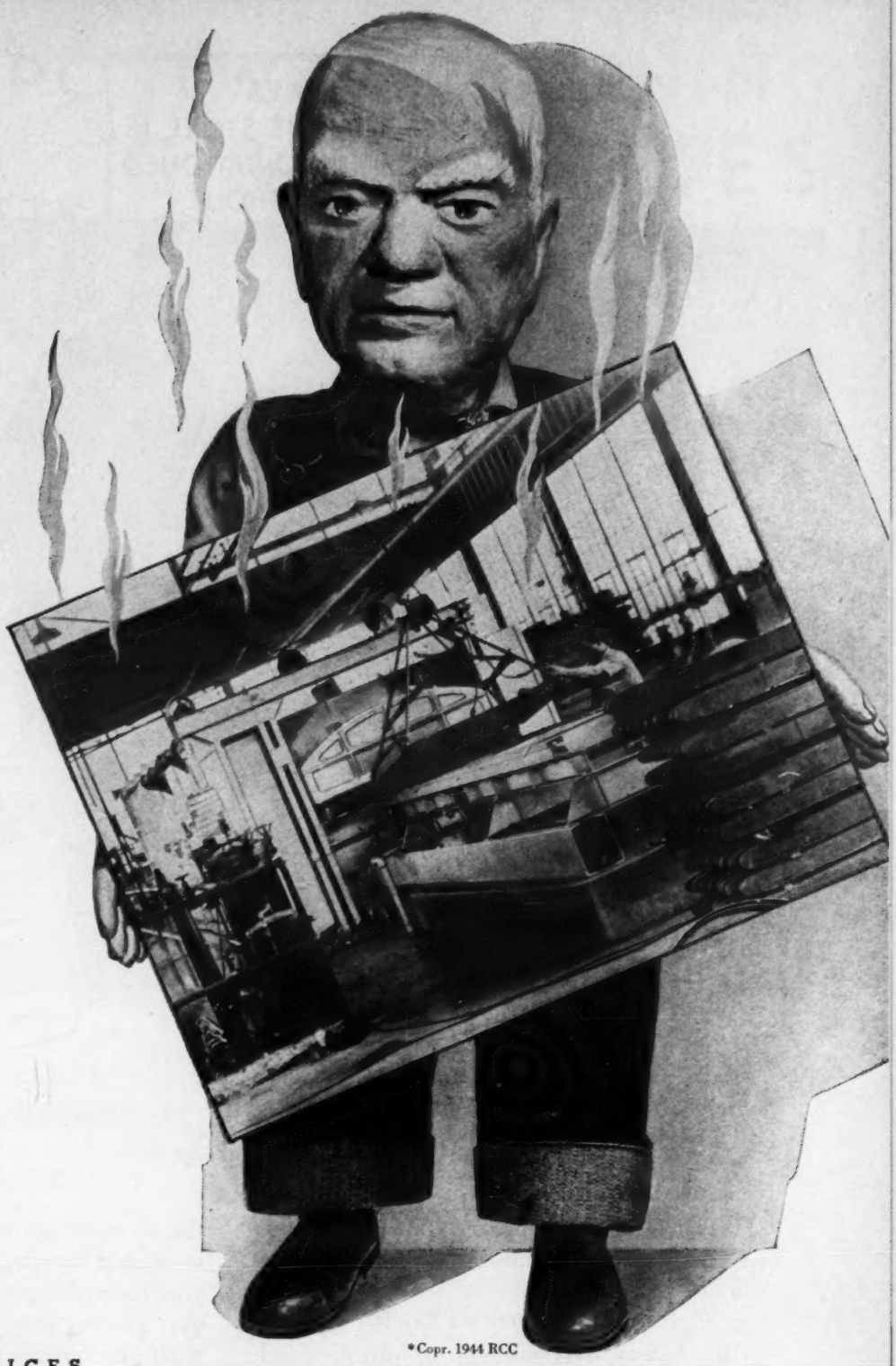
This resulted in the selection of an Ingersoll-Rand 28,500 sq. ft. surface condenser with divided water boxes, two vertical circulating water pumps, and two condensate pumps.* It was a good selection as attested by more than 2 years of excellent performance under severe war-time peak loads.

This is an example of Ingersoll-Rand engineering service. May we help you? Ingersoll-Rand Company, Cameron Pump Division, 11 Broadway, New York 4, N. Y.

**Other Ingersoll-Rand pumps in this extension include two boiler-feed units and twelve miscellaneous pumps.*

4-317

COMPRESSORS • TURBO BLOWERS • ROCK DRILLS • AIR TOOLS • OIL AND GAS ENGINES **Ingersoll-Rand** CONDENSERS • CENTRIFUGAL PUM



'Whew – this hot?"

says *Romey

e last word in heating
uipment, it brings the
pper up to exact tem-
rature for proper roll-
, with unfailing accu-
y.

just one of the many
sons why we are able
produce good wires
d cables.

nd us your inquiries.

*Copr. 1944 RCC

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See Your Telephone Directory

FROM BAR TO FINISHED WIRE

ROME CABLE
ORPORATION
OME • NEW YORK

First of a new Series of G-E Advertisements

This series, appearing in hotel, restaurant, store and theater publications, is designed to encourage post-war planning for air conditioning—a field that holds great opportunities, for you and for us.

"I hope you don't mind, Mr. Floorwalker, if I spend the day here?"

"Mind? Not at all, madam. As a matter of fact, we installed this air conditioning just for you. We like to have you here in our store, and the longer you stay the better we like it.

"By the way, have you noticed how nice and clean and fresh the merchandise stays? And we employees like the air conditioning, too. It helps to keep us on our toes."

* * *

Of course, not all stores have air conditioning like this. They can't get it now because all the air conditioning equipment we can make is needed for vital war jobs. But after the war you'll see plenty of stores putting in new General Electric systems—compact, flexible, and with precise control of temperature and humidity. Maybe yours will be among them.

For information, write: *General Electric Co., Air Conditioning and Commercial Refrigeration Divisions, Section 4192, Bloomfield, N. J.*

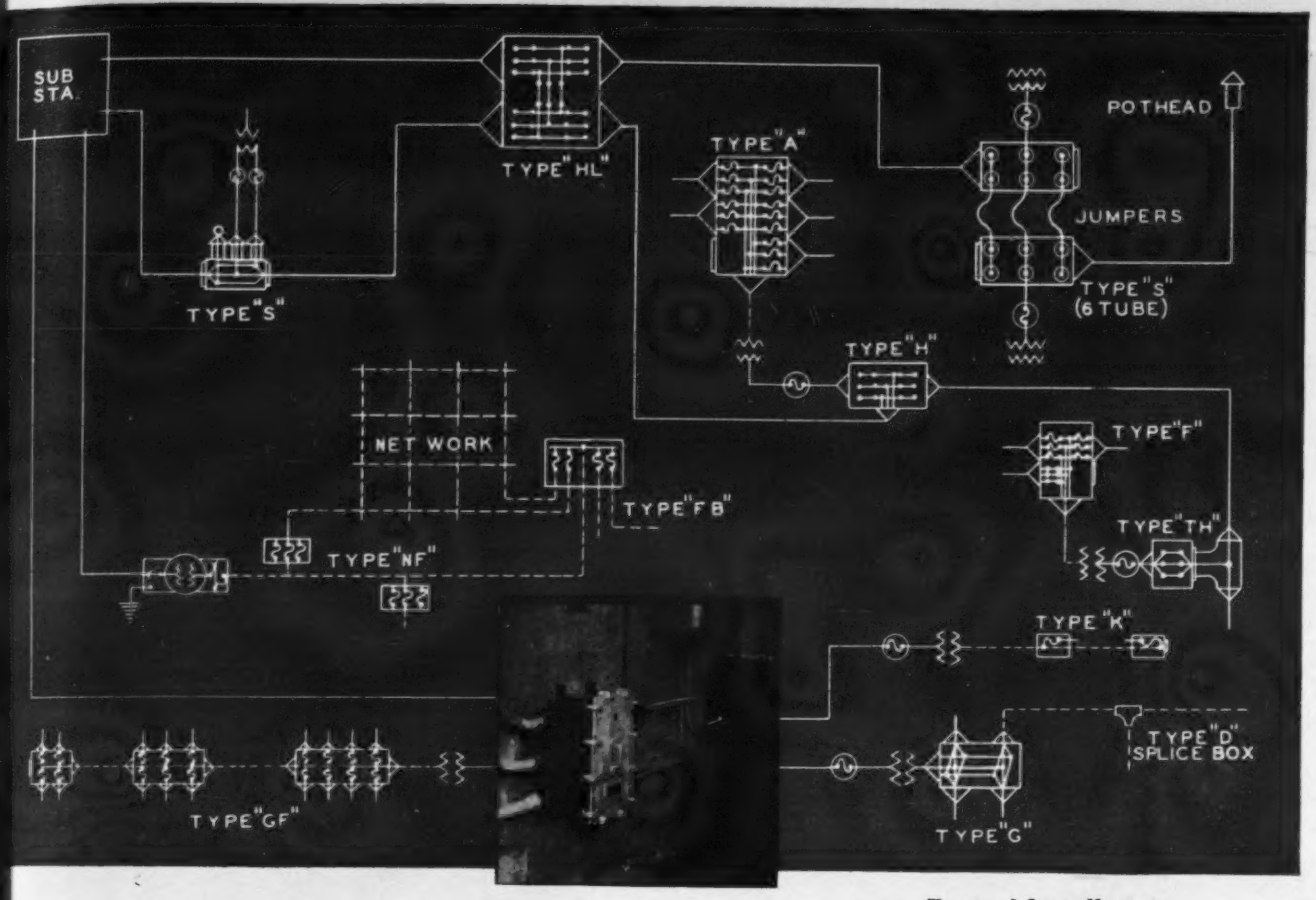
☆ BUY WAR BONDS ☆

Air Conditioning by

GENERAL ELECTRIC

Hear the General Electric Radio Programs: The "G-E ALL-GIRL ORCHESTRA," Sundays 10 P. M., EWT, NBC..."THE WORLD TODAY" News, Every Weekday, 6:45 P. M., EWT, CB

IN YOUR POSTWAR PLANNING *consider* G & W BOXES



Typical Installations

WATERTIGHTNESS INSURED

FACTORY TESTS—Boxes are filled with 5 to 15 lb. air pressure and submerged in a tank of water to make sure of NON-POROUS CASTINGS, sound welds and tight joints.

FIELD TESTS—After installation and after each time a box has been opened — make an air pressure test to insure that GASKETED JOINTS are tight. Use a tire pump and hold 5 lb. pressure for 15 minutes.

Underground cable boxes are an important item in an electrical distribution system. They establish the desirable control over the duration and the extent of service interruptions. The ideal system is one which provides maximum service continuity of service at minimum overall cost. The increased use of electric light and power makes it extremely difficult to arrange for even brief outages for necessary system changes and additions. Sectionalizing boxes permit circuit detours without dropping important loads. Fuse boxes minimize the extent of cable trouble. Distribution boxes provide for proper system maintenance with the least service interruptions.

G & W is always ready and willing to cooperate with you in designing and furnishing either cast or welded watertight boxes to meet your particular requirements.

Send for Bulletin No. 403

G&W ELECTRIC SPECIALTY CO.
Dependable Cable Accessories

7780 DANTE AVE., CHICAGO 19, ILL.

Also made in Canada by Powerlite Devices, Ltd., Toronto

A New Art

OF FORMING FORMICA SHEETS

War production has resulted in the development of new ways of forming completely cured Formica sheets. This method is highly successful commercially and at North American Aviation where Plastic Engineer William Beech developed it. Many parts shaped in this way, are in regular production and use.

Sharp bends can be made in the material without fracture. The inside diameter of the radius may be no greater than the thicknees of the material. The method is simple and fast—in every way efficient from the production point of view.

Formica so formed will not dent or deform under ordinary blows. It maintains its new shape under all conditions of humidity and climate. The parts are permanent, substantial and efficient.

"The Formica Story" is a moving picture in color showing the qualities of Formica, how it is made, how it is used. It is available for meetings of engineers.

THE FORMICA INSULATION COMPANY
4630 Spring Grove Ave., Cincinnati 32, Ohio

THE TECHNIQUE

Formica sheets are heated in an oven to a temperature somewhat higher than that at which they were cured—just under the blistering point. Then they are quickly inserted in a press with wooden or "Pregwood" forming dies and stamped into shape. When cold, the shape is permanent.

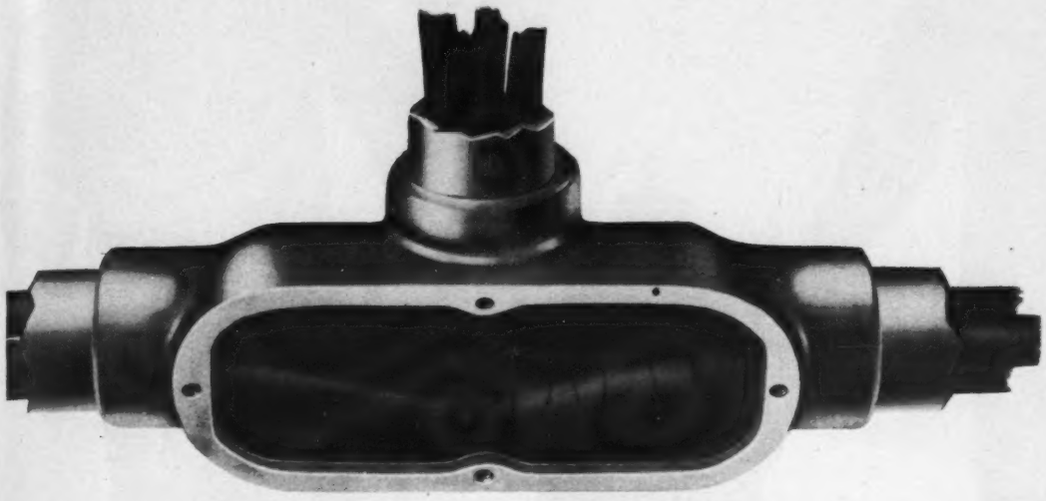
ARMY E NAVY

FORMICA

Wherever you need **more room** for unusual splicing, tapping, or pulling requirements,

use Form 8 CONDULETS

(CONDULETS are manufactured only by CROUSE-HINDS)



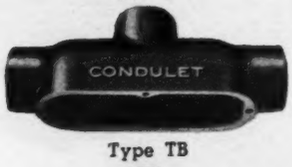
Type E

Type LR

Type LL

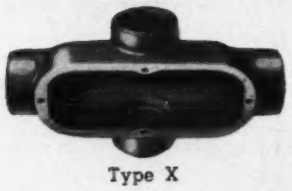
Type LB

Type C



Type TB

Type T


Type X

Large wiring chamber is both wider and longer. Will accommodate more or larger conductors.

Extra wide surface for gasket between Condulet and cover.

Dome shaped blank covers in sheet steel or cast Feraloy provide extra wiring space.

Bakelite covers, either blank or with two wire holes and three knockouts. Blank Bakelite covers may be drilled when more than five wires are required or to meet special requirements.

Sizes.—Thick wall threaded 1¼" through 4" Thin wall threadless 1¼" through 2"

A Nationwide Distribution Through Electrical Wholesalers

Sheet Steel Cover

Blank Bakelite Cover

Cast Feraloy Cover

Bakelite Cover with Wire Holes

CROUSE-HINDS COMPANY

SYRACUSE 1, N. Y., U.S.A.

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CROUSE-HINDS COMPANY OF CANADA, LTD., Main Office and Plant: TORONTO, ONT.

Brother... what I could do with this "putt-putt" back home

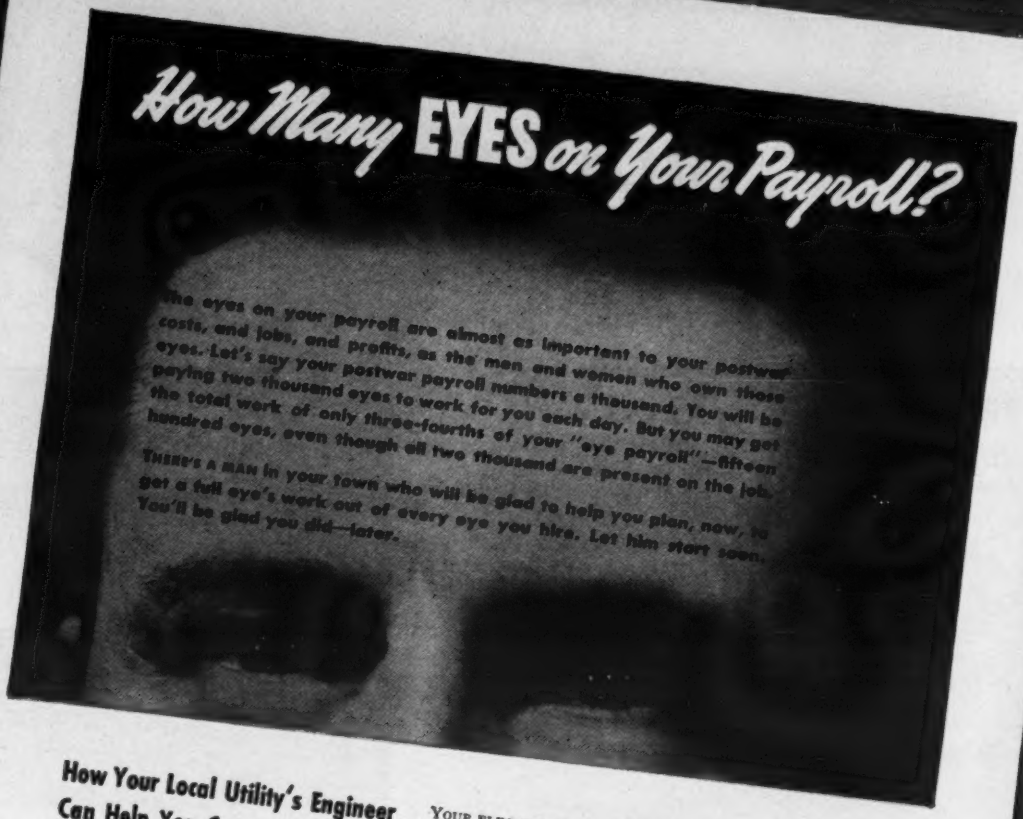
Homelite Portable Generators are affectionately known in the Armed Forces as "putt-putts". Men who see and *use* them . . . around airports, or in bombers and tanks . . . have come to know them for their dependable performance under the toughest possible conditions. Those men can see right now how ready and able these new, handy "putt-putts" will be after the war . . . for operating floodlights, electric tools, radios, signal systems and many other devices.

There's no doubt about it, ex-service men will be among the best supporters of Homelite Portable Generators . . . for right now, these "putt-putts" are supporting them, wherever they are, in every possible way.

HOMELITE CORPORATION

PORT CHESTER, NEW YORK

How Many EYES on Your Payroll?



The eyes on your payroll are almost as important to your postwar costs, and jobs, and profits, as the men and women who own those eyes. Let's say your postwar payroll numbers a thousand. You will be paying two thousand eyes to work for you each day. But you may get the total work of only three-fourths of your "eye payroll"—fifteen hundred eyes, even though all two thousand are present on the job.

THERE'S A MAN in your town who will be glad to help you plan, now, to get a full eye's work out of every eye you hire. Let him start soon. You'll be glad you did—later.

How Your Local Utility's Engineer Can Help You Cut Postwar Costs

YOUR ELECTRIC COMPANY'S lighting engineer can prove to you that better lighting can cut your costs by getting a day's work out of every eye you hire. He's near you—he's a practical man who knows plants—and can give you practical help.

Of course his company's got "something to sell." But give them credit for selling it intelligently. For knowing how to advise you, and being well able to tell you what better lighting can do.

Roebling has something to sell, too. When Victory comes, we hope you will remember Roebling as wire specialists who are a logical source of supply for the wires and cables you'll need to modernize... with better lighting... air conditioning ... better power distribution to your plant's work... full utilization of all the electrical and electronic cost-cutters the war has evolved.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

JAR ROEBLING

ROEBLING
PACEMAKER IN WIRE PRODUCTS

Wire Rope and Strand • Fittings • Cold Rolled Strip • Aircord, Swaged Terminals and Assemblies • Round and Shaped Wire Wire Cloth and Netting • High and Low Carbon Acid and Basic Open Hearth Steels Suspension Bridges and Cables • Electrical Wires and Cables • Aerial Wire Rope Systems

THIS ADVERTISEMENT is appearing in current issues of *Mill & Factory* and *Purchasing*, carrying the Better Lighting message to 39,569 industrial executives. When industrial load building becomes a problem again, we hope these 1944 Roebling messages will have helped to pave the way for your efforts.

REPRINTS of the advertisement available on request

2 NEW magnets by EC&M

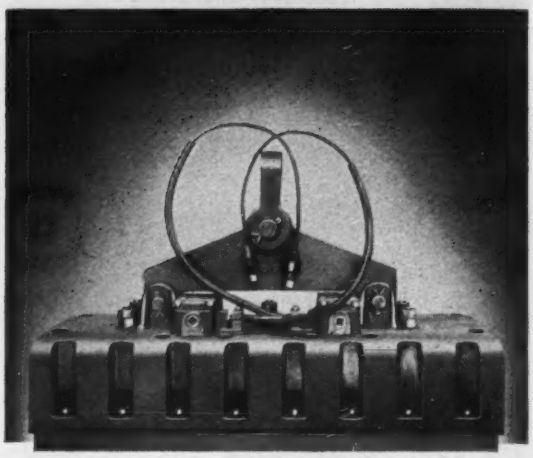
EC&M 65-in. diam. No. 6D Type SA Magnet

NO. 6D FOR OPEN-HEARTH STOCK YARD SERVICE

Handles More Tonnage in Less Time

You can judge from the view above something about the load this magnet carries—actually from 20% to 25% more—making it ideal for open-hearth stock yard and similar service.

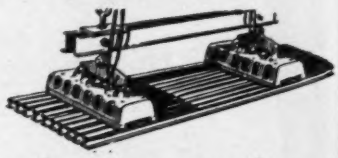
By conforming to size of charging boxes, it permits quick filling with minimum spillage. And with the standard automatic-discharge controller, the load is released quickly and cleanly. Ask for complete information—EC&M No. 6D.



EC&M Type BR Rail and Billet Magnet

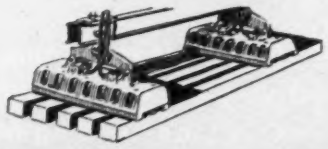
TYPE BR FOR HANDLING BILLETS, RAILS AND OTHER FINISHED PRODUCTS

Coils are Circular-wound of Strap-Copper



Here's something brand new in rectangular magnet design. Circular coils with strap copper, resulting in mean-turn of small length, tight winding and high magnetic intensity with reduced power consumption.

Two or three coils in individual, hermetically sealed cases are used. Other features are: water-proof terminal boxes; Class B insulation; renewable pole shoes; and suspension hanger permitting 2-way tilt of magnet and load.



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and in all the world of alloys

there's Only one

Nichrome*

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It takes more than a properly balanced union of nickel and chromium to produce genuine Nichrome.* There is always included at least one extra ingredient. • • Sometimes this hidden ingredient is an added trace of a third metal... an improved heating or quenching technique... or a specially developed deoxidizing anneal. But always it is the complete mastery with which D-H specialists employ their own exclusive methods and "know how." Remember this when next you buy electrical resistance or heating elements. • • For improved performance and longer life in your post-war products, specify Nichrome* and other resistance alloys by Driver-Harris—the time-tested standard of quality.

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HAS BEEN DEVELOPED

THE WEALTH of America has been wrought from her natural resources of fertile lands, wide forests and rich mineral deposits by the brains and muscles of her people.

But another resource is now available. A new source of wealth and well-being has been developing gradually and almost unnoticed which is tremendously important today and of still greater importance for tomorrow.

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Today, in hundreds of industrial and college laboratories, trained minds are expanding the world's knowledge, and applying the results of research to industry and to war.

In the Bell System, research has always been a fundamental activity. The telephone was invented in a research laboratory. And for years Bell Telephone Laboratories has been the largest industrial laboratory in the world.

Underlying modern research is the realization of vast latent values in nature. Although the lone genius does from time to time bring to light some part of these hidden values, only organized scientific research can assure the thorough exploration that will render the full measure of use for human welfare.

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These are the procedures of research. Its consummation is the grasping by subtle minds of relationships in nature no one has previously known. And on the basis of the broader knowledge so established are built new materials, new methods and new structures to serve the people of America.

The Bell Telephone Laboratories has now concentrated its efforts on communication systems and equipment for the armed forces. When the war is over its researches in communication will again be applied to an ever-improving telephone service in America.

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Standard Motor Control

FOR POSTWAR RECONVERSION

Westinghouse All-Purpose A-C Controls

Postwar reconversion will bring important control problems—you'll need all-purpose controls—and you'll need them quick.

Westinghouse is ready NOW to help you solve these problems—with a complete family of A-C Controls, a few of which are pictured here. They offer the maximum in flexibility of application and ease of installation.

Start now to anticipate your postwar control needs. For your assistance, Westinghouse has compiled a complete new volume of Control Buying Data (Catalog 7000). Get your copy today from the nearest Westinghouse district office (distribution will be made from district offices only—no mailings from Westinghouse headquarters). Westinghouse Electric & Manufacturing Company, East Pittsburgh, Penna.

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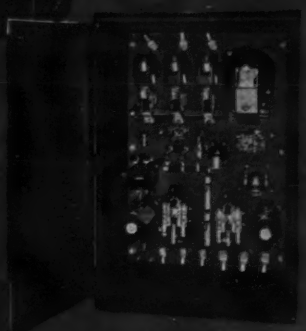
Motor Control

Across-the-line A-C Magnetic Starter for Squirrel-cage Motors.



Reversing and Non-reversing Magnetic Starter.

Autotransformer Type Magnetic Reduced Voltage Starter.

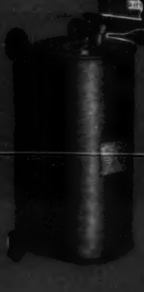
Starting and speed regulating Rheostat.

Manual Motor-starting Snap Switch.

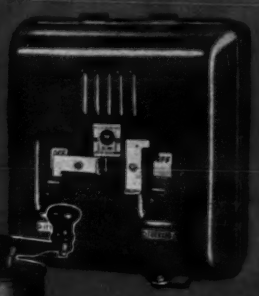
Reversing Drum Switches for Across-the-line Starting.

Type H Sectional Breaker for Fractional Hp Motor Starting.

Manual Multi-speed Drum Controllers.



Manual Multi-speed Drum Controllers.

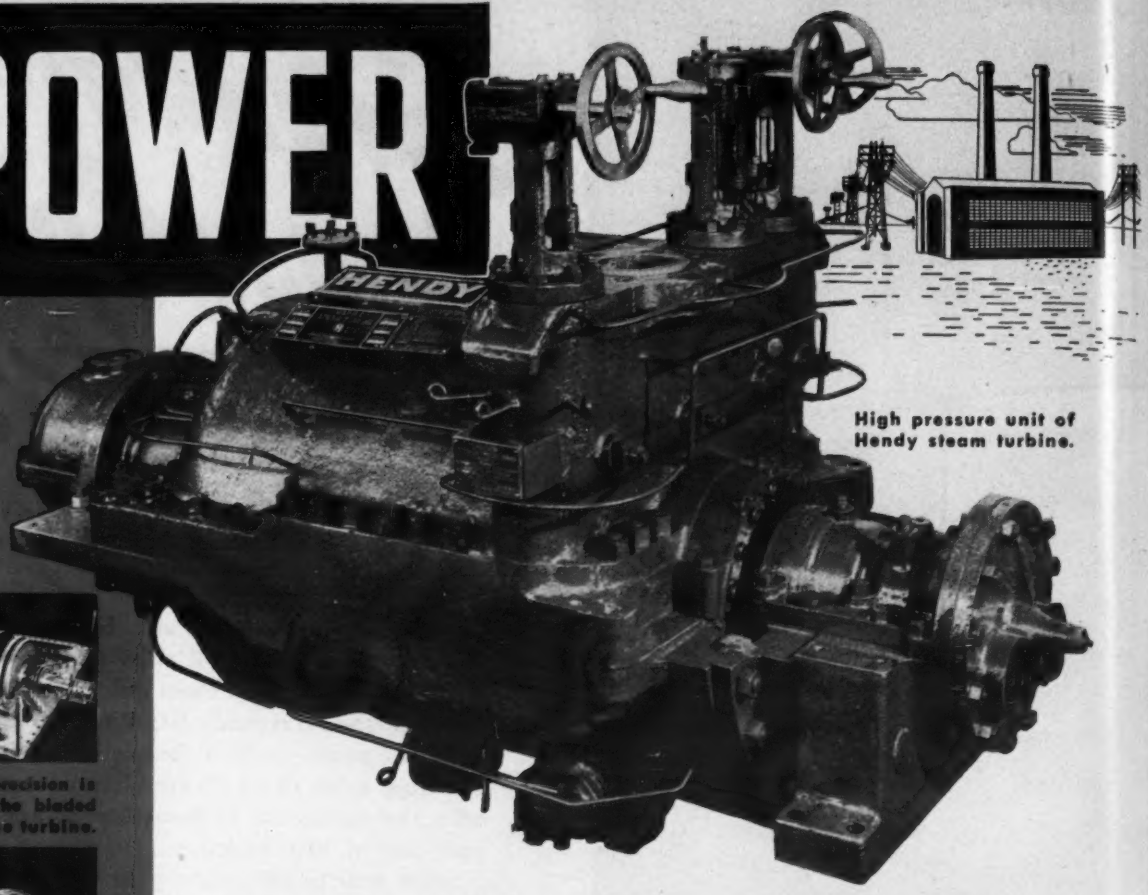


"De-lon" Motor Watchman Reversing and Two-speed Manual Starters.

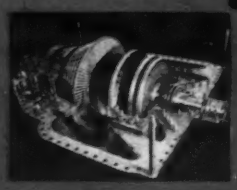
Across-the-line "De-lon" Manual Motor Starter.

Reversing Drum Controller for use with Primary Resistance.

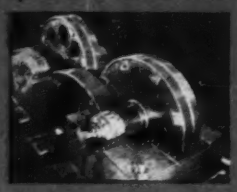
POWER



High pressure unit of Hendy steam turbine.



The utmost precision is essential in the bladed spindle of the turbine.



Hendy marine reduction gear unit for the 4,000 hp C-1 power plants.

THE BALANCE OF POWER

The assurance of long life and low maintenance for a turbine depends on how well such a power unit is balanced. One way is to build them—and then compensate for weight differences. But the correct way is to build each of the 4,000 parts so meticulously to precision dimensions in the first place that the unit doesn't have to be balanced by supplementary means. Then it will always remain in balance for there's nothing artificial about it!

For a smooth-running vibrationless unit—you can rely on the "balance of power" in a HENDY built turbine.

FOR THE SEA TODAY ...for INDUSTRY tomorrow

Challenged to put steam turbines on a mass production basis, Hendy telescoped into twenty months a decade of turbine manufacturing progress. In doing so a new chapter has been written in the history of turbine production, and as well new standards of quiet, smooth turbine performance have been created by the Hendy product.

Now entirely for marine service, the output from Hendy includes turbines for 300 kw generator sets, 4,000 hp, 6,000 hp and 8,500 hp turbines for propulsion of cargo ships—in addition to complete reduction gear units for them.

Post-war industry will find performance in Hendy turbines—will find them prime movers whose dependability has been thoroughly established in war service.

JOSHUA HENDY Division

JOSHUA HENDY IRON WORKS

ESTABLISHED 1856

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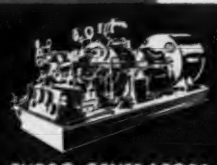
BRANCH OFFICES: Boston · Buffalo · Chicago · Cincinnati · Cleveland · Detroit · New York · Philadelphia · Pittsburgh · San Francisco · St. Louis · Washington · Los Angeles



TURBO-GENERATORS

REDUCTION GEARS

STEAM TURBINES

DIESEL ENGINES

Iron wire as a heating element?

Yes, iron wire might be used as a heating element, but at very low temperature indeed. If it ran at red heat, it would burn out in a jiffy, as you well know. All other wires (except platinum) likewise burned out too soon, until Chromel was discovered, back in 1906. It's easy to take Chromel for granted, because it ranks with a lot of other good things. We talk about it, merely to keep you mindful that Chromel just about did create the heating device industry, and made electric heat practical and useful in so many ways. For technical data on Chromel, ask for Catalog-M.

Chromel
NICKEL CHROMIUM
HOSKINS
CHROMEL
ELECTRICAL HEATING ELEMENT
WIRE

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We could truthfully illustrate this advertisement with ships, planes, tanks, or jeeps — with practically any electrified piece of mechanism serving on the fighting line or on the production line. In every one of these devices somewhere — *motor, generator, transformer, tube or control,* there is a vital spot where the maximum of insulation dependability is essential — and there you find *Mica.* In many cases it is *Macallen Mica.*

In your product engineering work for post war production you are going to use *Mica* where no substitution is possible — and also for that extra margin of safety, you will use *Mica* wherever there is any element of doubt.

Macallen Mica is the product of 50 years of specialized skill and experience in processing *Mica* to its greatest possible usefulness. Our engineering department will cooperate with you.

50th Anniversary book — Macallen & Mica — Yours for the asking.

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Compressed Sheets—Mica Paper, Cloth, Tape, Heater Plate, Compressed Sheet Tubing—Commutator Insulation—Compressed Sheet Washers—Insulating Joints and Canopy Insulators—Railway Specialties—Domestic and Imported Raw Mica.

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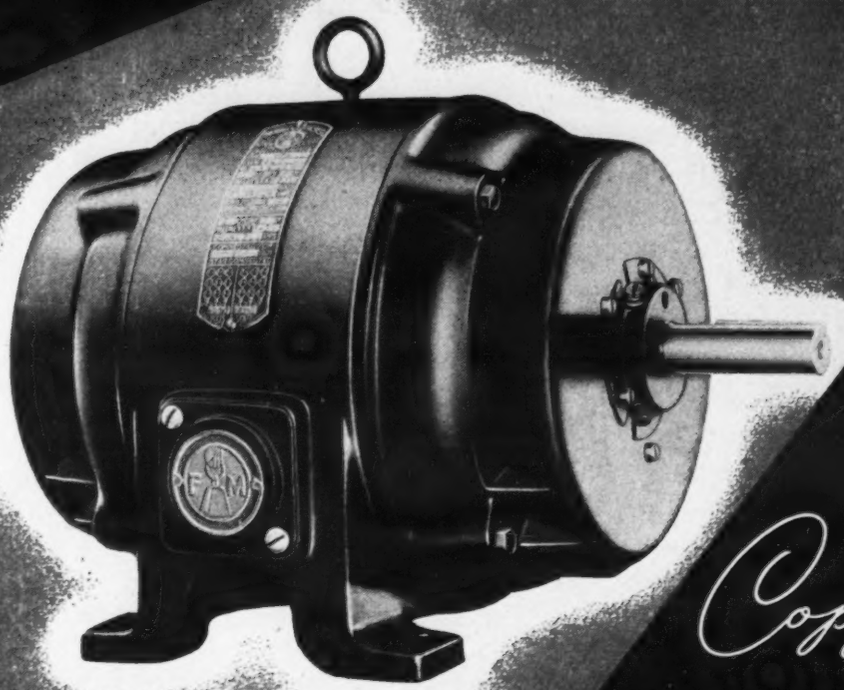
MOTORS NEED THEM

—now more than ever, since motors have become so precious — as essential a part of our war effort, in fact, as artillery; and harder to replace. Shawmut Therm-A-Trips safeguard them, make them more efficient, and enable them to give more and better service. Therm-A-Trips allow them to start on excessive overloads which are insufficient to cause damage, and to run on harmless temporary overloads; they protect circuits and their equipment, and prevent unnecessary setbacks and stoppages in production. They are made in three forms, plug, ferrule, and knifeblade, in a range of ratings from 0 to 600 amperes, 250 and 600 volts. Ask your dealer about them, or write for our Bulletin 405.

FUSE MAKERS SINCE 1893

The Chase-Shawmut Company
Newburyport, Massachusetts

A Challenge to the Future ...in Motor Design



Copperspun ROTOR

Here is the new Fairbanks-Morse general purpose, continuous duty motor—designed for the future—available now! Never have more stamina, versatility and protection been built into a motor housing!

BUY WAR BONDS

NOTE THESE FEATURES

- **It is a 40°C. motor.**
- **It is a protected motor.**
- **It has an optional conduit box assembly.**
- **It has cross-flow ventilation.**
- **It has ball bearings—sealed in cartridge type closures.**
- **It has exclusive Fairbanks-Morse *COPPERSPUN ROTOR*.**

Write Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

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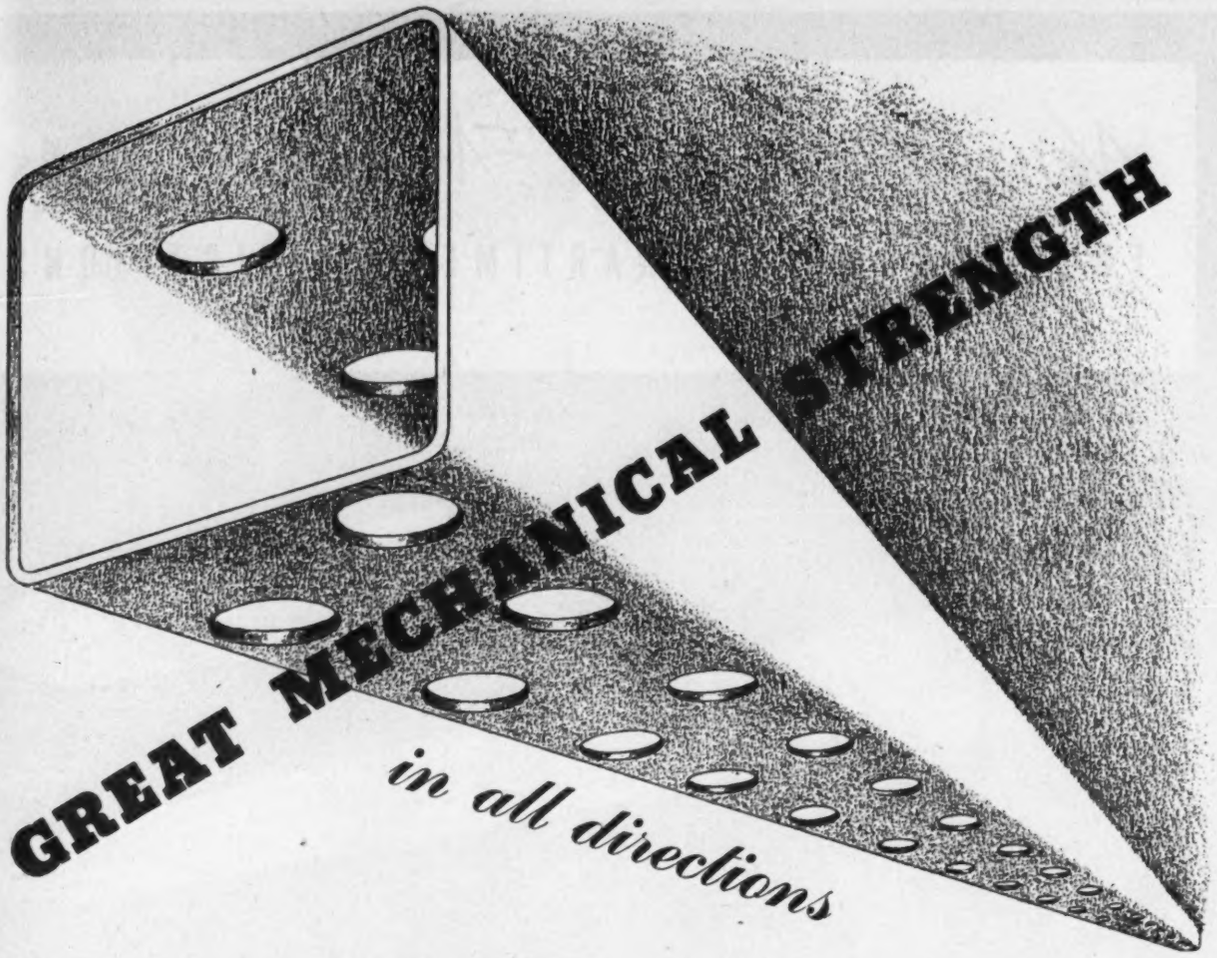
Motors



CHASE VENTILATED BUS CONDUCTOR

You get maximum strength in both directions per pound of copper with Chase Ventilated Square Tube. And that's just one of many advantages of this efficient bus conductor.

Exceptional rigidity eliminates the need for auxiliary clamping devices. Ventilated holes for cooling by natural convection provide high current carrying capacity. These copper-conserving features combined in a bus conductor of simple one-piece construction deserve further investigation in planning new AC bus installations.

BUS CONDUCTOR CALCULATIONS GOT YOU SNOWED UNDER?

Chase may be able to save you many hours of work on electrical problems. Why not consult Chase engineers on the most economical size and shape of bus conductors for your conditions? To take advantage of this service, simply outline your conductor requirements.

CHASE

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Subsidiary of Kennecott Copper Corporation

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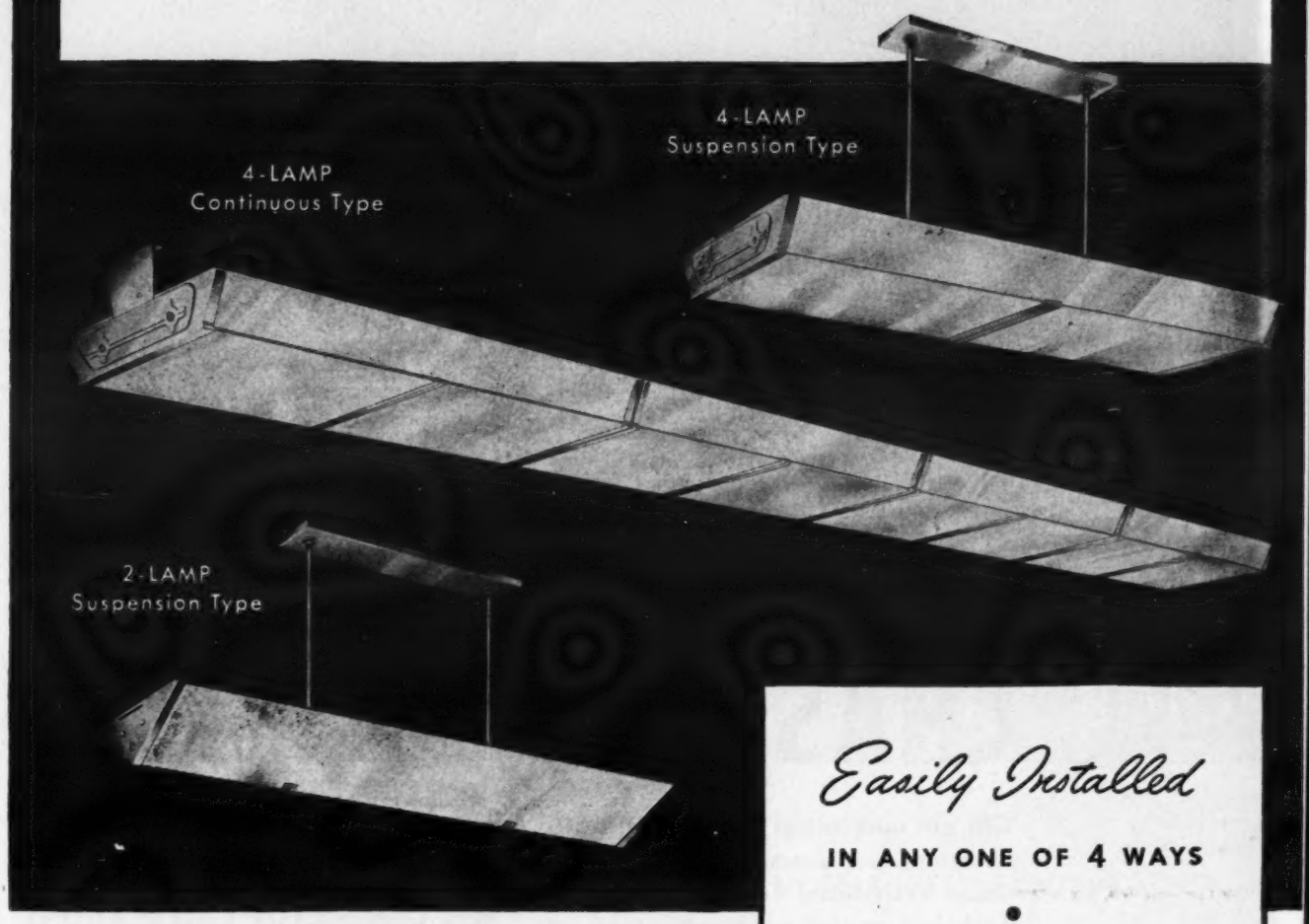
This is the Chase Network —handiest way to buy brass

New! FLUORESCENT Luminaires

FOR ESSENTIAL WARTIME APPLICATIONS



For better illumination of war-production offices and drafting rooms, Westinghouse introduces a new line of Commercial-type, Fluorescent Luminaires. Used as individual fixtures or for continuous strip installations, they furnish a wide range of high intensities . . . and without shadows or glare.

Handsome in appearance and sturdily built, these efficient luminaires are *now* available through 117 Westinghouse Electric Supply Company offices and Independent Westinghouse Lighting Distributors.

Get full details today! Or write Westinghouse Electric & Mfg. Company, Edgewater Park, Cleveland, Ohio, for bulletin B-3332.

Easily Installed

IN ANY ONE OF 4 WAYS

1. As individual units, with twin-stem hangers.

2. As individual units, mounted flush with the ceiling.

3. For continuous strip applications, with twin-stem hangers.

4. For continuous strip applications, mounted flush with the ceiling.

Westinghouse Commercial-type Fluorescent Luminaires are available with or without the glass panels illustrated above.

Westinghouse *Lighting Equipment*

PLANTS IN 25 CITIES OFFICES EVERYWHERE

Tune in John Charles Thomas, NBC, Sundays, 2:30 P.M., E.W.T.

In no line of industry are modern developments for the better protection of public and employees more eagerly sought and accepted than by the electric light and power companies.

This attitude is evidenced by the keen interest exhibited by progressive managements of such companies in the possibilities offered by RCA systems for 2-way emergency radio communication between company offices, shops and service and construction trucks.

Emergency action for public safety and maintenance or restoration of service is greatly aided by equipment of this type.

RCA engineers will gladly advise you. Please address inquiries to Emergency Communications Equipment Section, RADIO CORPORATION OF AMERICA, Camden, N. J.

RCA

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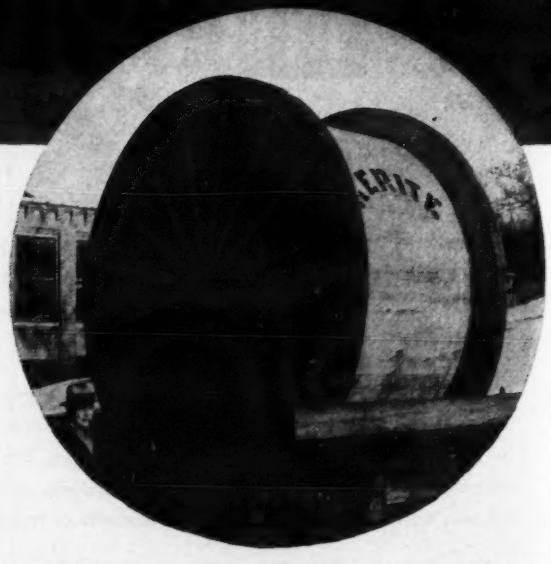
RCA EMERGENCY COMMUNICATIONS EQUIPMENT

RADIO CORPORATION OF AMERICA

Pioneers in Cable Engineering



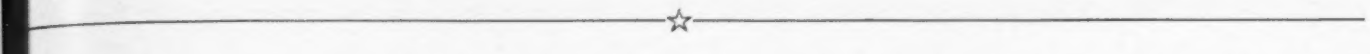
PROPER HANDLING

of Finished Cable is essential to the preservation of the excellence built into the product.

THE KERITE INSULATED WIRE & CABLE COMPANY INC
NEW YORK CHICAGO SAN FRANCISCO

Free Enterprise

. . . INCENTIVES AND TAXATION



here are three principal ways of making a living:

1. Getting on someone's payroll
2. Lending one's savings to business enterprises
3. Starting, or helping to start, a business enterprise

bout three out of four of us fall in the first oup—we are ***job-holders.*** Millions of us get me income, large or small, by lending our savgs—directly or through such channels as inrance companies. We are suppliers of ***loan-pital.*** About one out of four of us has his n business enterprise, and several millions of are part owners of business enterprises. Those us who go into business for ourselves and ose of us who are part owners of enterprises ***job-givers.***

The amount of employment in a community pends, in the main, on the number of persons o attempt to make their living, or part of their ing, by giving jobs to others, rather than by tting on someone's payroll. A community iously desiring a high level of employment and a high standard of living will strive to make job-giving attractive and to encourage a large part of its population to be job-givers rather than merely job-holders.

The number of men who attempt to make their living in whole or in part by starting new businesses or by expanding old ones depends upon the outlook for profits. When the outlook for profits improves, thousands of new jobs open up and thousands of men go to work; and, as men go to work, the farmer and everybody else benefits. When the prospect for profits becomes darker, the demand for labor, capital, and raw materials drops. It may be roughly estimated that an improvement in the prospect for profits of one billion dollars raises the demand for labor by anywhere from two billion dollars to five billion dollars.

One of the principal determinants of the outlook for profits is the amount and the nature of taxes. After the war, the Federal government will need to raise each year about twenty billion dollars in taxes—three times the amount required before the war, and six times the amount re-

quired in the Twenties. In the Twenties, the tax needs of the Federal government were roughly twice as large as corporate profits in a good year. After the war, Federal revenue needs will be roughly three times corporate profits in a good year. Obviously, it will be much more difficult, after the war, for the government to meet its needs *without discouraging enterprise,* and therefore without diminishing the number of jobs, than it was before the war. Far more than ever before, it will be necessary for the government in developing a tax program to take account of the effect of taxes upon employment and the standard of living. This means that it will be important for each and every citizen to give attention to these matters—because the policies of the government reflect, in the main, the thinking of the citizens.

Some taxes seriously discourage individuals and business firms from undertaking new and enlarged operations. Other taxes have little or no adverse effect on investments. Some taxes are a burden on consumption, affecting the sales of specific commodities, depending on the nature of the taxes. It is obvious that different kinds of taxes have different economic influences. *We must understand the forces that determine the level of employment and consider the tax program in relation to other measures designed to create more jobs.*

What are the tests of a good tax system?

1. **Taxes should be designed to encourage production and enterprise and to make it attractive for a large number of people to earn all or part of their living by giving jobs to others.**
2. **Taxation must be fair in principle and administration, with no discrimination between persons in similar circumstances.**
3. **Taxes should be apparent and not concealed, and should be levied, in the main, directly upon individuals so that each of us will know how much our government is costing him. A moderate income tax at the lower income levels will bring a greater awareness of responsibility than will heavy taxes on consumption which the taxpayer does not see because they are hidden in the prices he pays.**
4. **In the aggregate, taxes should be somewhat progressive.**
5. **The tax system should be coordinated with the broader objectives of monetary and fiscal policy.**

6. **Federal, state, and local tax policies should be integrated as to principles and objectives.**

Judged by these standards, our present tax stem is extremely unsatisfactory; in fact, it is tually damaging. It is a conglomeration of dden and direct taxes and of conflicting taxing risdictions and policies, with no comprehen- e economic motive. It is distorted to appease essure groups and includes uneconomic puni- e measures. It is full of needless complexities. is a paradise for tax lawyers and a source of nfusion and despair for the honest, enterpris- g business man. In fact, it would seem almost if our tax laws had been written by some fifth lumnist for the purpose of making private terprise unworkable. We in America pretend believe in the pioneer spirit, but no one would er suspect it by looking at our tax system. When the war is over, there must be a thorough form of our entire tax system. Federal taxes can d should be reduced substantially; and, in the ocess of reduction, changes can more readily introduced. At that time, steps can be taken achieve some degree of coordination and unity purpose among federal, state, and local taxing encies. Taxes play too important a role in our tal economic life to ignore the adverse conse- ences of unrelated and inconsistent policies of different taxing jurisdictions.

The following reform measures are needed in federal taxation:

1. **Repeal of the excess profits tax at the earliest possible date after inflationary dangers subside. In the case of most enterprises, the excess profits tax destroys all incentive to do a larger volume of business than in 1939; it appropriates virtually all increase in profits above the level of 1939.**

2. **Coordinate corporation and individual income taxes so as to avoid double taxation and impediments to risk-taking. Preferably, corporation income taxes should be wholly eliminated. Otherwise, the corporation tax rates should be reduced to the lowest effective rate on personal incomes. Full credit should be given to stockholders for all corporate income taxes paid.**

3. **Encourage competition and particularly the formation of new enterprises by allowing new corporations generous tax exemptions for a period of five years. Extend the same principle to unincorporated concerns.**

4. **Encourage risk-taking (and hence job-**

giving) through extending the loss carry-over to six years or more.

5. Provide for averaging incomes over a period of years in order to remove discrimination against those with irregular incomes and those who take risks of loss in business ventures.

6. Rely upon the personal income tax as the main source of revenue, with broad coverage. The reduction in total taxes after the war should favor the elimination of excise taxes before reducing income taxes.

7. Reduce the upper range of personal income tax rates to a maximum of perhaps fifty to sixty per cent so that risk-taking investments will be really attractive. Higher rates are punitive in character, yield small receipts, and throttle risk-taking.

8. Encourage risk-taking by individuals in the higher brackets by making the surtax on incomes of $20,000 a year or more half as much on income in the form of dividends as on income in the form of salaries or interest.

9. Encourage risk-taking by individuals by permitting capital losses to be charged against general income pro- vided the reduction of tax liability i any one year is not more than fift per cent.

10. Repeal the tax-exempt privilege fo all *new* securities issued by all gov ernmental jurisdictions.

11. Eliminate excise taxes which place disproportionate burden on person with lower incomes so as to encourag greater consumption and provide a expanded market for our vast indu trial capacity.

12. Reform tax administration to simpli forms and procedures, to broaden t scope of enforcement, and to encou age the spirit of fairness.

With such reforms and continuing reappra of the tax program as it affects the econom situation, we can look toward taxation as an strument of constructive influence in giving t fullest encouragement to free enterprise and attaining continued prosperity.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company,

Unionization of Engineers

Do engineers need a union and, if so, should that union be a part of or affiliated with one or more of their professional engineering societies? That question has been precipitated by the action of the American Society of Civil Engineers authorizing local sections to set up collective bargaining units for professional engineering employees and subscribing $50,000 annually for the employment of four field representatives to organize and help the local bargaining groups. Members of these local groups do not have to be civil engineers or even members of A.S.C.E., they can be any engineer who qualifies as a professional engineering employee.

Last week the board of directors of the American Institute of Electrical Engineers took cognizance of the situation and authorized the appointment of a committee to study broadly the whole subject of employment of electrical engineers, including security of employment, compensation and collective bargaining.

There will be many who will resist efforts to organize engineers on the grounds that engineering is a profession and not a standardized occupation wherein you can classify jobs. Engineers, it will be argued, work with their minds and there is no way to standardize compensation for judgment or responsibility or creativeness. Others will oppose efforts to make a national engineering society the labor union for its members on the grounds that such societies are bodies for the discussion of ways to improve the art, that they include both employees and employers and that as labor organizations they would be restrictive rather than progressive.

Nevertheless, the fact remains that engineers, and particularly the younger ones who have not advanced to supervisory positions, are more and more conscious of the need for some form of collective action that is of their own choosing. It isn't that engineers want to belong to a union; the mere fact that they are turning to their national societies is indication that they want to preserve their professional status. It is exceedingly bad for the morale of these men to be made a part of a trade collective bargaining group. If they must be a part of some group, they want to choose the group so that their professional character will be recognized in any group discussion of employment matters.

These are matters that cannot lightly be pushed to one side by our older engineers who are not personally confronted with these employment problems. Nor can we go to the other extreme and say that these are days of rapidly changing social concepts and that since collective bargaining is making such headway we should recognize it for engineers and take it over in our national engineering societies rather than jeopardize membership by letting some other body organize the engineers.

Judgment in this matter should be reserved until the facts are known, and then if unbiased analysis indicates a plan it should be followed just as courageously. That is the true engineering approach. This is no time for prejudice. Knowledge based on facts must be our guide. And that is why the action of the A.I.E.E. board should appeal to all engineers.

If this study—and it cannot be too comprehensive, for only a thousand dollars has been appropriated for it—indicates the need for a wider survey or some further action, it is hoped that the participation of all the national engineering societies can be secured. If engineers are going to organize, they should provide the strongest kind of an organization possible and should act in harmony as engineers.

Demand Down—Production Up With Auto-Starting Welders

Automatic starting and stopping of welding machines at California shipyard cuts kw. demand 22 percent—Arc time totalizer increases production 20 percent

NOEL E. PORTER and W. M. NOTT*

IN THESE DAYS of stringent shortages of men, machines and power distribution equipment it is highly important that all available facilities be put to the most efficient use. Any increase in efficiency, existing manpower and equipment has the effect of creating production tools as well as additional production where they did not exist before.

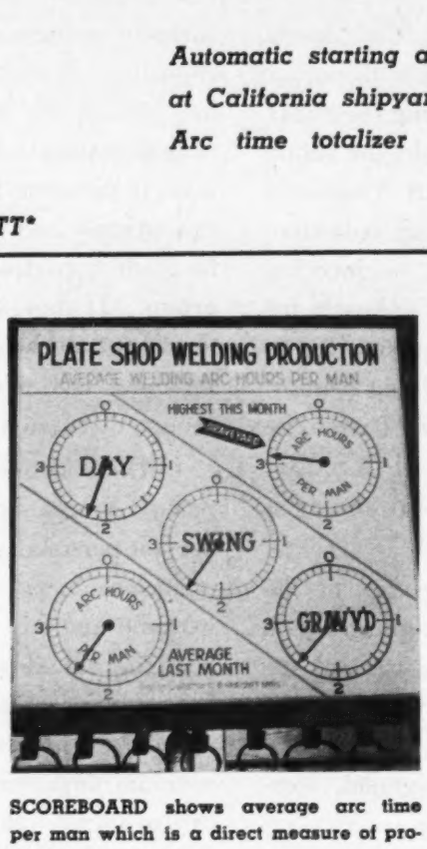
At Richmond shipyard No. 1 of the Permanente Metals Corporation every effort has been made to attain efficiency in the highest degree. On some lines which were previously loaded to capacity it is now possible to add up to 30 percent more welding machines without the addition of a single transformer or a foot of distribution line. Power factor has been increased on welding loads without the use of further power-factor corrective equipment and the kw. demand normally required for welding machines has been reduced appreciably. In addition, welding production is being increased materially—as much as 20 percent in one section of the yard.

This increase in the capacity of the yard's equipment to handle increased production demands is being accomplished by the use of an automatic welding machine starter and arc time totalizer. This unit does three things:

1. Stops the welding machine after a short period of no welding, the delay period being adjustable up to three minutes.

2. Permits the operator to start the machine automatically by touching his rod to his work.

3. Registers total arc time of the welding machine. Neither idling time nor the time the rod is shorted to the work is measured.



SCOREBOARD shows average arc time per man which is a direct measure of production.

Pointers are set from readings of arc time totalizers on each individual welding machine. A synchronous motor driving a cyclometer register records arc time in hours and tenths of hours.

The effect of the automatic starter on the electrical distribution system is due to the elimination of the large no-load losses drawn by the average heavy-duty, single-operator, motor-generator welding machines. A 300-amp. machine will draw between 2.5 and 4 kw. while idling, the actual value being dependent on the make of machine as well as current and voltage settings. For a bank of several different makes of machines an average of 3 kw. no-load demand per machine is a conservative estimate. This demand is supplied at a power factor ranging between 40 and 50 percent, the average kva. demand being between 6 and 8 kva.

Because of the relatively low arc time usually inherent under shipyard conditions, the electrical distribution system is loaded with power flowing to drive idling welding machines. In the system where there is little or no power-factor corrective equipment the situation is aggravated by the large reactive current required by each machine.

Automatic Starter

The automatic starter, by cutting out most of the idling time of the machines, reduces the average kw. demand per machine considerably, at the same time increasing the power factor of the system. The electrical circuit of the starter is shown in the accompanying diagram. When the machine is at a standstill the 8-volt secondary of the transformer *TR* is applied across the terminals of the welding generator through the contact of relay *B*. When the operator touches his rod to his work the generator is short circuited and the a.c. current flowing through the welding cable closes relay *A*, one contact of which is in parallel with the start button contact. As soon as the interlocking contact of the motor starter is closed the coil of relay *B* is short circuited and the transformer secondary is removed from the d.c. line. As the d.c. voltage builds up relay *C* opens the circuit to the coil of relay *B*.

When no current is flowing through the welding cable relay *A* opens and makes a back contact which energizes the motor of the time delay relay. If no arc is struck during the interval for which the time delay relay is set, the contact of relay *D* opens and stops the machine. When the d.c. voltage decays to about 8 volts, relay *C* opens

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and its back contact energizes relay B, which again applies the transformer secondary to the line. If an arc is struck before the end of the time-delay period the delay relay is de-energized by the operation of relay *A* and immediately resets to zero.

It is interesting to note that the operation of the arc time totalizer *T* is dependent on the proper operation of both relay *A* and relay *C*, so that both welding current and voltage must be of the correct values before arc time is recorded. This prevents operation of the totalizer by shorting the rod to the work or by idling time alone.

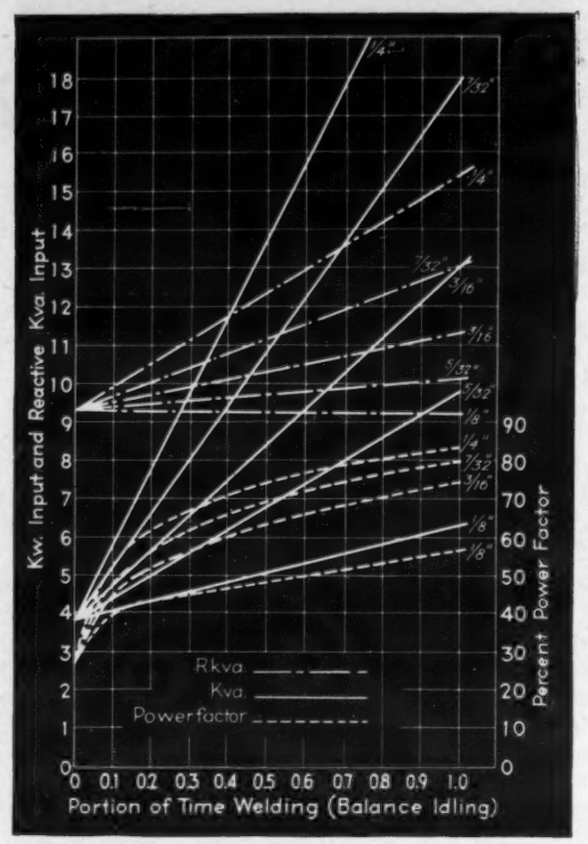
The arc time totalizer consists of a small synchronous motor driving a cyclometer register which registers in hours and tenths of hours.

At Richmond No. 1 there has been installed in excess of 300 units on which tests have been run, showing a saving of 25 percent in the total power required. One section of the yard in particular has been carefully tested. This section is equipped with 165 machines which are delivering the highest percent arc time found in the yard. Installation of the starters decreased the over-all kw. demand for this section (including cranes, power machinery, etc.) by 15 percent. It is estimated that the decrease in welding machine demand alone in this section was about 22 percent. Coupled with the fact that this represents a correspondingly greater reduction in the kva. demand, the effect on a well-loaded distribution system and on the reduced need for power-factor corrective equipment becomes evident.

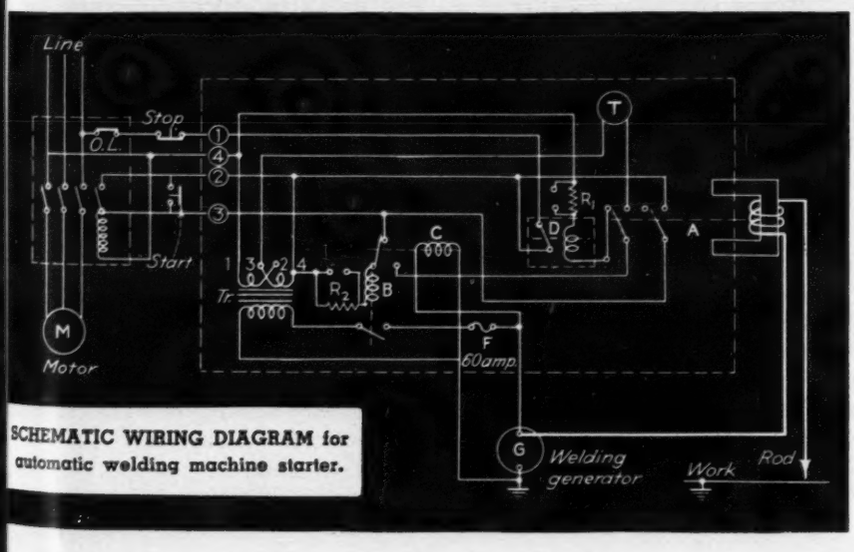
In the section of this yard where tests were made average power factor ran around 85 percent due to existing corrective equipment. Installation of the automatic starters increased this power factor to 90 percent. If capacitors had not been previously installed the increase in power factor would have been much greater.

While the power savings, increased line capacity and increase in average power factor are very satisfactory, it has been found that the most valuable feature is the arc-time totalizer. While its potentialities have not yet been fully investigated, preliminary experiments have shown excellent results through increased production.

A large scoreboard showing the average arc time per man on each of the three shifts has been installed in the plate shop. This scoreboard also shows the highest average arc time produced by any shift during the current month and the average arc time for all shifts during the preceding month. The dial readings are kept up to date, each pointer being changed as soon after the end of each shift as possible. This arrangement gives the welders visual evidence of the amount of work they are doing as a group in comparison with the other groups. Due to the competition automatically set up by installation of this board, and without additional pressure on the part of the foreman, welding production increased almost 20 percent in a few weeks time. Similar scoreboards will be set up in other sections of the yard.



AVERAGE CURVES showing kw. and rkva. demands and power factors for different proportions of welding time and various size welding rods on a large group of 300-amp., d.c. welders. Note that when idling, demand is 4 kw. and rkva. 9.2. Automatic starters reduced demand, raised power factor and saved killowatt-hours



SCHEMATIC WIRING DIAGRAM for automatic welding machine starter.

It was originally felt that lineal feet of weld per arc-hour would be a constant for any given size of rod, weld and working condition. However, actual test data have shown variations between welders as high as 25 to 30 percent. Investigation has shown that this variation is largely due to differences in the technique used in the welding operation. In other words, a welder using the best technique may produce 25 or 30 percent more feet per arc-hour than a welder using a poor technique under identical conditions. While the variation usually does not run as high as this, it emphasizes the importance of proper training of welders and of checking those now doing production work to see that they are getting the maximum possible feet of weld per arc-hour. Any improvement in tech-

nique will, of course, increase the welder's production without increase in effort.

The arc-time totalizer has also been of material assistance in reaching maximum possible use of welding machines. Since it is quite often difficult to determine the exact extent to which the welding machines in a given section are being used, the tendency is to make sure that enough machines are on hand to satisfy welding production demands, and this results in an overestimate more often than an underestimate. Since an idling machine records no arc time, use of the totalizer makes it much easier to locate machines which are not being used and transfer them to sections where they are needed.

Studies are now being made of welding production per unit time and welding duty cycle by use of the totalizer which will assist greatly in establishing production in the yard on a more scientific basis. The complete possibilities for increasing production have not yet been thoroughly explored, but it is felt that the preliminary results may be considered as being very satisfactory.

This equipment was built by the Hewlett Packard Company of Palo Alto, Calif.

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Lamp Renewals Halved in Power Plants

Average monthly lamp consumption at generating stations of the Oklahoma Gas & Electric Company has been cut from 350 in 1938 to between 175–200 per month in 1943. This reduction in lamp consumption has been effected among a total of 765 sockets, about 25 percent of which are represented in extension cords.

Conservation of lamps, particularly desirable at the present time, has been brought about by the simple expedient of requiring operators and maintenance men to turn in an old lamp for every new lamp issued. In many cases it was found that lamps, particularly on extension cords, were being discarded before the end of their useful life. Where such practices existed records of lamp renewals quickly disclosed which departments were obtaining the shortest lamp life and steps were taken to correct the condition by employee instruction.

Why Not Meter and C

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IT IS THE PURPOSE of this paper to point out the operating and economic advantages which may be gained by installing current transformers for metering or control in the neutral leads of three-phase "Y"-connected equipment.

In what follows only metering applications will be discussed, but what is said about current transformers for a meter can be applied as well to current transformers for any other device requiring phase current for its operation provided it is not required to operate on fault currents within the device to which it is connected.

At normal frequency and within

FIG. 1—Conventional practice places current transformers in line leads of primary of power transformer no matter what the voltage

normal metering accuracy the current passing through a winding of a three-phase "Y"-connected piece of apparatus is the same in magnitude and phase angle whether measured at the line or neutral terminals of the winding. The only difference that exists is the charging current passing from the line terminals through the capacity of terminals and winding to ground. This current is too small, however, to be detected on meters and equipment ordinarily used. The fact that the load current is the same in both ends of the winding has been taken advantage of for years for differential protection of rotating machinery. It is therefore rather surprising that so few application and operating engineers seem to have studied the possibilities of inserting the current transformers for the metering devices in the neutral leads of such apparatus rather than on the line side.

High-side Metering

The diagram shown in Fig. 1 represents the high-tension winding of a three-phase power transformer or bank. The phase-to-phase voltage is immaterial; it may be 220,000 or 220 volts. As indicated, it is "Y"-connected with a solidly grounded neutral. Assume that the power flow is from the high-tension to the low-tension winding. This would make it necessary to install the metering devices in the high-tension circuit to obtain a reading of power supplied including losses in the transformer.

Obviously the current and potential transformers of the metering device indicated in Fig. 1 are subjected to the full line voltages of the circuit, also to any transient voltages or lightning surges built up across the impedance of the main transformer winding. In addition to these voltages there is a corresponding set of voltages built up across the impedance of the current transformers. In the location shown all metering elements are subjected to the vector sum of the related voltages. It is hardly necessary to point out that failure of the insulation of any one of the metering transformers will result in the interruption of power to the main transformer.

Advantages in Neutral

On the other hand, if the current transformers for the meter were inserted between the neutral terminals of the main transformer windings and the neutral bus, as indicated in Fig. 2, the primary winding of these current transformers would only be subjected to whatever voltage may be built up across their own impedances. The effect of the main transformer

Control in the Neutrals of Wyes?

Substantial savings in materials and installation costs could accrue if current transformers were placed in neutral connections — Pros and cons of provocative proposal

impedance will be to reduce the magnitude of any induced surge voltage originating on the line resulting in a corresponding reduction in this voltage across the current transformer. The voltage conditions for the potential transformers would remain substantially the same as before.

To appreciate fully the advantages of the arrangement proposed it is necessary to analyze the voltage conditions of the connections in the neutral of a grounded three-phase bank or machine.

Insulation Factors

In the conventional location, indicated in Fig. 1, should the insulation of the current transformer be punctured by a surge voltage the normal voltage of the circuit will generally maintain a current flow until it is interrupted by some protective device. The amount of power liberated in the fault will depend on the short-circuit conditions and the clearing time, but normally, it will be very large. For this reason the damage to the current transformer will be serious and probably necessitate immediate replacement.

With the current transformer located as shown in Fig. 2, on the other hand, and all connections intact, the potential of the primary circuit is not present. As stated previously the only voltage that does exist is that built up across the impedance of the current transformer.

The 60-cycle impedance of a 400-amp., 5,000-volt current transformer of a particular design is about 0.0006 ohm and therefore the normal full load voltage is in the order of 0.24 volt. This voltage will vary inversely with the current rating of the transformer actually used. For all practical purposes this voltage is insignificant. The thickness of the insulation between the primary conductor and the core of a 5,000-volt current transformer is in the order of $\frac{1}{8}$ in. or more.

Should a surge occur capable of producing a voltage across the current transformer impedance of sufficient magnitude to cause a puncture of the insulation between the primary conductor and the core this voltage would immediately collapse. It should be noted that one of the primary terminals, as well as the core of the current transformer, is solidly connected together and to ground. Due to the fact that the voltage in back of the fault collapses at the instant of fault the resulting damage may be expected

FIG. 2—Less steady state and transient stress would be imposed on current transformers if they were placed in the neutral connections

to be small. With a $\frac{1}{8}$ in. or better separation between the primary conductor of the current transformer and ground and a normal voltage of less than one volt, it may also be safely assumed that after conditions have returned to normal the current transformer may still be able to function as before, at least to such a time as it can be conveniently replaced.

In above a failure from the primary winding to the core of the current transformer was assumed. It is obvious that a breakdown of the insulation between the primary and secondary windings would be less serious than with the current transformer in the conventional location. It has also been assumed that the grounding system is continuous, of adequate capacity to handle the short-circuit currents and all equipment involved, including the transformer neutral, is connected to this grounding system. Should this not be the case dangerous voltage conditions may readily be introduced due to differences in voltage drops across the ground resistances. However, this applies to either of the two current transformer locations discussed.

Selection Recommendations

Certain manufacturers have published recommendations for the selection of current transformers to be used in solidly grounded neutral connections of three phase "Y"-connected equipment and the table shown below is a copy of one of these recommendations. Manufacturers having no control over the installation of their equipment cannot be expected to do anything but provide safeguards against possible misuse; we would therefore expect a good safety factor, and this is quite evident on inspection of the following table:

Table I

Phase-to-Phase Voltage of Circuit	Voltage Rating of C.T. in Neutral	Test Volts in Kv.
0-7,500	5,000	50-60
7,501-15,000	7,500	76
15,000 and above	15,000	95-110

When above current transformers are used on circuits with a voltage corresponding to their voltage ratings they are generally protected by lightning arresters. The crest voltage of a particular type of 15,000-volt grounded neutral lightning arrester with 10,000 amp. flowing through it is about 44,000 volts. The relation between the test voltage of the 15-kv. current transformer as given above and this crest voltage gives an idea of the "safety factor" afforded with normal co-ordination and under normal usage of these current transformers. This factor is about 2.25 to 2.5:1 for

15 kv.; it varies from 1.5:1 for 110 kv. to 3:1 for 5-kv. transformers using one particular make of arrester and current transformer as a reference.

If desired, higher safety factors may be obtained in the neutral leads by providing bypass arresters. The cost of a 600-volt arrester as commonly used on secondary lines is about $2.50. This arrester would limit the voltage rise to about 3.5-4.0 kv., therefore using 5,000-volt current transformers would give a safety factor of better than 12:1. A standard line of bypass protectors is also available. These are usually recommended for current transformers of high voltage or low current capacity only.

Transformer Costs

Relative costs of the current transformers given in Table I are as follows:

Table II

C.T. Volt Rating	Price of Indoor	Outdoor
5,000	$15.00 to 22.00	$52.00 to 77.00
7,500	45.00	69.00 to 95.00
15,000	58.00	91.00 to 118.00

Where current transformers are necessary due to the magnitude of the load current, the distance between the meter and the device metered, or for other reasons, it seems that the use of a transformer with a voltage rating above 5,000 could be justified only where the metering accuracy, thermal limits or the secondary burden exceeds that allowed for this transformer. The reason for this voltage limit is that at this time, so far as the author knows, this is the lowest standard voltage rating available in outdoor design with characteristics suitable for metering burdens. In indoor types 600 volt is available at a saving in cost over the 5,000 volt.

Table III indicates the initial saving possible with neutral metering as against line metering on the basis of outdoor applications and 5,000-volt current transformers.

Table III

Volts		Dollars	Material in Pounds*
110,000	Saving per Phase	1,500.00	2,055
66,000	Saving per Phase	550.00	480
33,000	Saving per Phase	300.00	275
15,000	Saving per Phase	45.00	80
4,000	Saving per Phase	0.00	0

*Includes iron, oil, copper and insulation.

The actual saving will differ from the figures indicated, depending on type of transformers used, but will be substantial for the higher voltages. So will also be the ultimate saving when maintenance and installation expense are taken into consideration.

For all practical purposes the primary winding of the current transformer is at ground potential. Hence, with reasonable precautions, it should be possible to install a jumper around the current transformer to permit replacement if this becomes necessary and this without disturbing the supply to the main transformer.

To carry above reasoning a step further, there seems to be no reason why the meter coils could not be inserted directly in the neutral leads of the circuit, dispensing with current transformers entirely, provided, however, that the load and short-circuit currents are within the range of available standard meters. Such an installation would hardly be practical except where the meter can be located immediately adjacent to the main transformer and where good and solid ground connections can be obtained.

Watt-Hour Meter

Standard watt-hour meters are now available with a 50 amp. nominal rating supposedly capable of a sustained overload of four times normal. The current coils will withstand 60 times normal current for one second. Therefore, where the short-circuit current is 3,000 amp. or less and suitable protective devices are installed on the line side of the main transformer with time characteristics within the limits of the meter there should be small danger of a failure due to overcurrent.

All "Y"-connected systems or equipments are not necessarily solidly grounded; in some cases resistances, reactors, impedances, automatic or non-automatic disconnecting devices are used or the neutral left ungrounded "floating." In all these cases the potential normally existing between the neutral point of the equipment and ground is substantially below that of the line; only during transient or unbalanced load conditions does it approach that of the line to ground potential of the system.

Safety Factor

To select a current transformer for any one of the above conditions it is necessary to determine the maximum voltage to which the transformers may be subjected and the period of time such a voltage may exist. With a suitable safety factor the test voltage of the current transformer, rather than the operating voltage for which it is designed, *may be* used as a guide when it is only a question of transient voltages, as will be the case where resistances, reactors or impedances are used in the neutral. Where disconnecting devices are used or the neutral left floating the probabilities are there will always be a voltage existing between the neutral point and ground; therefore the normal operating voltage of the current transformer *must* be used as a guide in the selection. In the latter case it will probably be found necessary to use transformers of the same voltage rating as would be the case were they installed directly on the line side of the equipment metered.

The logical question is, then, why not put the current transformers on the line side? For the same reason as was pointed out in the beginning of this paper, normally, and under transient conditions, they will be subjected to a lower voltage than if they were on the line side, thus a higher safety factor is obtained without increase in cost of the equipment. Further, in case of an insulation breakdown in the current transformer the system to which it is connected may not be subjected to a line short circuit and the service interrupted. The fact that the service *may* not be interrupted should be given consideration.

Summary of Conclusions

Inserting current transformers in the neutral leads of three phase "Y"-connected machines or equipment, for the purpose of metering or control, offers the following advantages not found in the conventional method:

1. Increases the reliability of operation.
2. Makes possible a substantial saving in investment and maintenance particularly at higher voltages.
3. Saves critical material.
4. Does not require special equipment.

In the past, the general practice has been to put all current devices except those used for differential relaying on the line side of the machine or equipment terminals. If the suggestion outlined in this article is followed all current devices will be connected in the neutral leads of the machine or equipment except those used for relaying of internal faults.

In conclusion, I wish to express my appreciation for the interest and suggestions offered in the preparation of this article by J. L. Harvey, superintendent of power control, of the New York Power & Light Corporation.

Wooden Towers Save Critical Material

Two 140-ft. structures built of 32 wooden poles —Four-legged A-frame superstructure mounted on four tripod legs — Erected on concrete piers

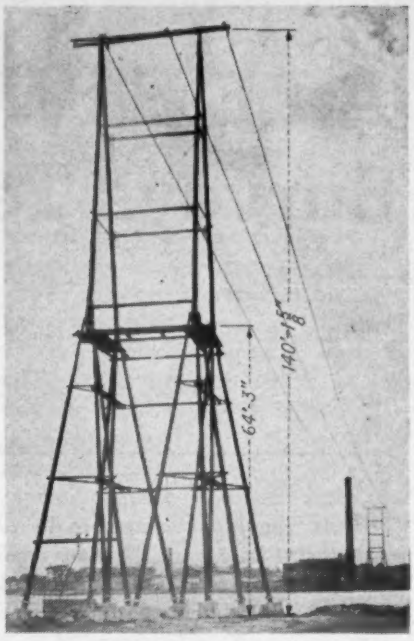
SELF-CONTAINED wooden towers without guys or separate anchor structures were utilized in a 22-kv. overhead crossing of the Merrimac River at Newburyport, Mass., recently designed and erected by the New England Power Service Company. Less critical material was required than with a submarine cable. The river is nearly 1,400 ft. wide at this point and 115-ft. clearance is necessary above high water for navigation. The design and erection were expedited by a model (scale 1:48).

Each structure consists of a four-legged braced wooden pole tower 70 ft. high, with each leg mounted on top of a tripod of 70-ft. poles, making 140 ft. total height. The design provides for six extra-strength $\frac{7}{16}$-in. copperweld conductors with 1,397-ft. span. Heavy stresses in the superstructure were cared for by designing connectors suitable for round poles, the basic idea being a shear angle welded to a gusset plate or member in order to spread the bearing stress over an increased area of wood, bolts being required only to hold the different parts together.

Foundation on one shore comprised shallow concrete piers to distribute soil pressure evenly on an old wharf mat of interlaced native pine trees surrounded by cribwork bulkheads and filled with miscellaneous material. About 2 ft. of soil was removed from the general area where the pressure would be downward and piled around the foundations where the pressure would be upward.

All poles (28 70-ft. and four 75-ft.) were furnished without framing. Tripods and bents were laid on the ground on skids and accurate cuts made there. Both towers were framed on the same side of the river, one being towed across. In erection, the tripod poles were set and braced by usual means. A working platform at 65 ft. was installed.

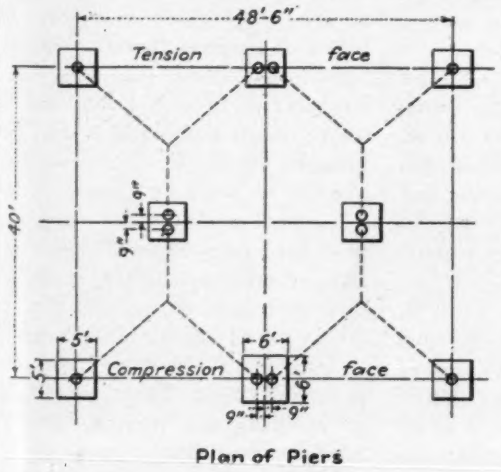
Erection of the four-legged tower above the 70-ft. ground section presented some difficulty. The first superstructure was jack-knifed into place. The top is in the shape of a single pin hinge to eliminate eccentricity. A temporary second hinge was made up at the platform level; two superstructure poles were set up vertically with butts on the ground and crossarm and bracing in place. The other two were laid horizontally with their tips made up in the permanent hinge and



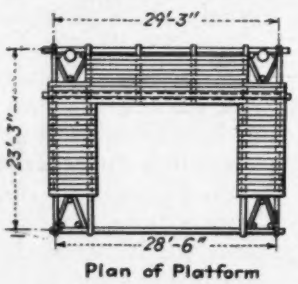
TOWERS AFTER ERECTION for Merrimac River crossing, looking toward Newburyport steam plant

their butts in the temporary hinge. Two redundant or brace poles saved from the bottom section were used as gin poles to lift the verticals as high as possible. At maximum height the gin poles were walked back as far as possible toward the tower, the lift being completed by pulling back on the top until the superstructure was in position to permit making up the splice plates.

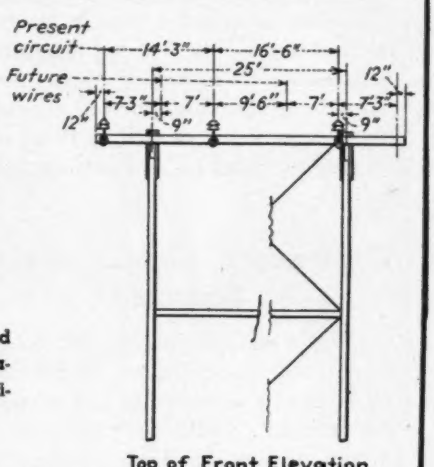
A simpler method was possible for the second tower. The bottom section was erected as before. Then the redundant poles were hoisted part way up the tower and lashed to serve as gin poles. The permanent hinge was made up for each set of poles, making up the top A-frames, which were separately hoisted into place.



Plan of Piers



Plan of Platform



Top of Front Elevation

TOP OF 140-FT. TOWER and plan of piers; initial installation three conductors; ultimate six

A.I.E.E. Winter Meeting Surveys Technical Trends

Wartime measures the major theme of papers and conferences — Others lay developmental basis for transition to normal engineering future — Generator standardization focuses on P.F. rating

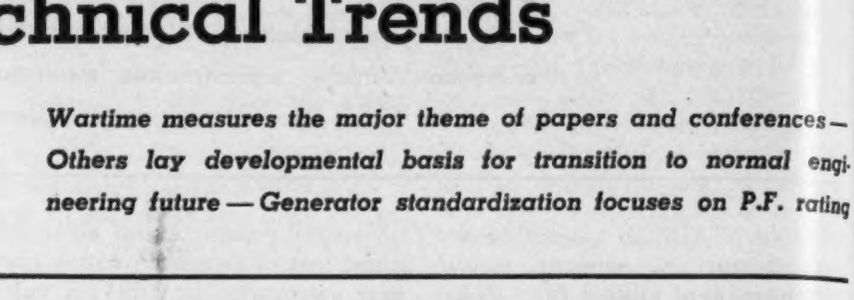
THEMES having intimately to do with technical tooling of the war again dominated the winter meeting of the American Institute of Electrical Engineers in New York, January 24 to 28, 1944. Mingled in with these was a substantial number of formal papers and conference presentations which lay a firm base for post-war engineering. Sessions were well-attended, occasional overflows resulting in conference gatherings because so much space in the Engineering Societies Building has been given over to war activities.

Programmed topics covered a broadening range and there were releases of several new devices, prominent among them being a group of new circuit interrupting devices for high and low voltage. Another was a polarized-light controlled servo-motor.

Whether generators to match the proposed standard turbines should have 0.80 or higher power factor rating was threshed out at one of the still-growing informal conferences. Two well-diversified conference meetings were sponsored by the committee on industrial power applications.

Relaying was another field to which there was accorded a sizable assignment of time on the five-day program.

Attendance, including those participating in the discussion of aircraft electrical systems as well as those attending the joint I.R.E. meetings, was 1651.



D. C. Jackson, Jackson & Moreland; Gano Dunn, J. G. White Engineering Co.; I. E. Moultrop, Boston; T. F. Barton, General Electric (left to right)

Conference on Generator Ratings

Kilovar margins in generators dominated the discussion of the characteristics of alternators to couple with the A.S.M.E. committee's recommendation of five standard 3,600-r.p.m. turbine ratings of 12.5, 20, 30, 40 and 60 mw., each with guaranteed maximum capacity of 110 percent. The A.I.E.E. portion of the joint committee tabulated the characteristics of over 15,000,000 kw. of present capacity as a guide to current requirements. Chairman Oldacre pointed out that sacrifice of the prevailing 25 percent margins in turbo-generators rated at 0.80 p.f. would impinge on the capability to handle swings, unpredictable loads and operating conditions, and loss of interconnection. Eighty-six percent of the surveyed capacity has nameplate ratings of 80 percent or higher, but only 7 percent has 90 or higher.

M. D. Ross (Westinghouse) showed how the D^2L (volume) of the rotor, used as an index of weight and cost, would drop for increases in rotor temperature rise, hydrogen pressure and rated p.f., the latter being 15 percent from 0.80 to 0.90 p.f. Higher short circuit ratio runs the weight up.

Comparisons were drawn by J. B. McClure (General Electric) between the field and armature limitations of the two ratings. He concluded that if the present 0.8 p.f. generator is at all adequate, then it would be much too large on the proposed basis. Also, he felt the choice should logically lie between 0.85 and 0.90; the latter would appear to be adequate if the user would be willing to run at higher hydrogen pressure for short periods. S. H. Mortensen (Allis-Chalmers) pointed out that temperature of cooling water for hydrogen is a factor.

Power Factor Rating

When the utility engineers entered the discussion there was plenty of advocacy of retaining the 0.80 p.f. rating. Peak load power factor is not a sound basis for choosing the kvar. ability, since many rotors are subjected to severest thermal loading at light load and low p.f. This was the comment of Messrs. Foote and Dissmeyer (Commonwealth & Southern) brought by J. R. North. After a number of years on base-load operation some machines are relegated to peak load or spinning reserve operation, others carrying the kvars. while their successors carry kilowatts; more failures occur under these conditions and the 0.80 machines have proved none too ample. They urged caution in reducing the thermal ability of 3,600-r.p.m. fields.

Is it more economical to carry

kvars. on generators or on capacitors? asked H. K. Sels (Public Service Electric & Gas). An adoption of 0.90 or 0.95 would necessitate capacitors. F. W. Gay (same company) also wants 0.80, believing that 60 percent of the capacity should be assigned 91 percent of the kw.-hrs. and favored to perform at 10,000 B.t.u. or better.

Bad experience with high p.f. generators at Detroit and the relatively short distances of the system led S. M. Dean to prefer having the kvars. of the 0.80 p.f. units; even 0.75 p.f. units were pretty handy for war loads. Also a little extra flexibility is very comfortable. He would rather not handicap system objectives to save a little on the alternator. As lower p.f. ratings are chosen the costs of kvar. capacity increments begin to approach the installed cost of capacitors, according to R. P. Crippen (Ebasco Services); a transmission type of system calls for kvar. margins in generators. He cited one generously capacitored state-wide system which has trouble carrying the kilovars when a steam unit is lost.

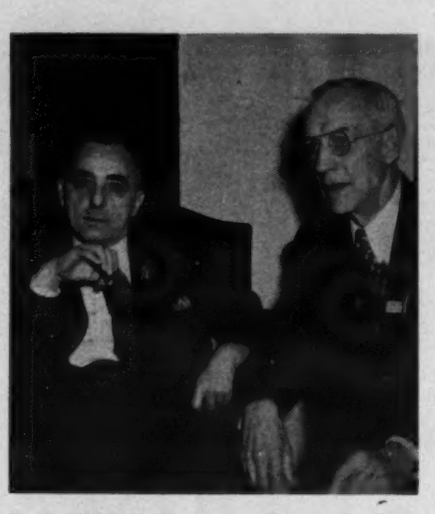
Generators and Systems

Regulation of A.C. Generators with Suddenly Applied Loads. By **E. L. Harder** and **R. C. Cheek** (both Westinghouse).

Focuses on problems of starting relatively large motors on power-house-auxiliary and industrial generators. Comprehensive analysis shows importance of transient reactance and open-circuit time constant, regulator performance. P. F. variations up to 40 percent have negligible effect on drop. Numerous graphs included.

Steady-State Stability of Synchronous Machines as Affected by Voltage Regulator Characteristics. By **C. Concordia** (General Electric).

Fast regulator and exciter action and low transient reactance desirable. Amortisseurs



S. J. DeLuca, Delaware Power & Light, and Walter F. Potts, Rumsey Electric Co.

and stabilizing transformers have little power-limit gain effect. For maximum power-limit gain, regulator should have broad regulation and rapid response.

Lightning Protection for Rotating Machines. By **G. D. McCann, E. Beck, L. A. Finzi** (all Westinghouse).

Specific quantitative recommendations for machines (both grounded and ungrounded) and for associated cables and overhead lines; also machines feeding through transformers. Emphasis on low-discharge-voltage characteristics.

The Effect of Kilovar Supply on the Design of System for Load Growth. By **T. W. Schroeder, J. W. Butler** and **N. H. Meyers** (all General Electric).

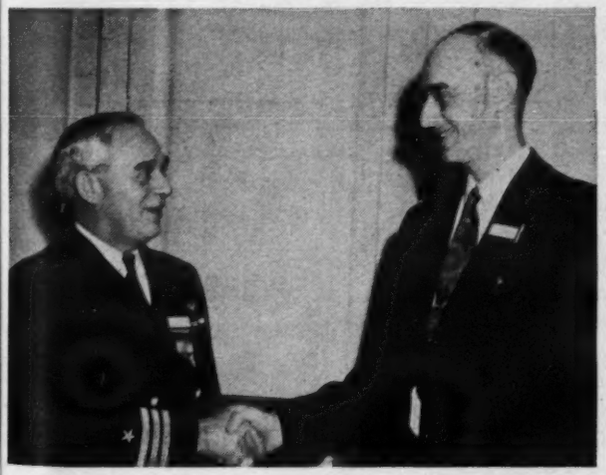
For typical system: 10 percent saving; residential feeders most favorable; 33-kv. industrial feeders not favorable; system losses reduced; long, heavy feeders highly favorable.

Separate excitation usually results in lesser voltage drop than the self-excitation treated in the Harder-Cheek paper, commented F. V. Smith (Sargent & Lundy). Harder admitted this, even where all parameters are identical, merely because the initial rate of response is higher, although the average rate may be identical with that of self-excitation.

The machine-lightning-protection paper precipitated discussion of the relative merits of valve and Deion types of arresters. W. J. Rudge pointed out that the principles advanced were the same as in two earlier General Electric papers. On the choke coil proposal, he said, only one had been adopted in a considerable number of cases where its efficacy had been investigated. He hoped the paper would be instrumental in getting machine users to give attention to adequate protection for them. E. R. Whitehead (Duquesne Light) cited an instance where a 1-to-1 insulating transformer (5 kv.) in conjunction with line surge arresters was instrumental in keeping surges out of machines.

I. W. Gross (American Gas & Electric Service) was not so sure about the effectiveness of the protection as he was enamored of the idea that absence of surges might be the explanation of virtual absence of surge troubles in generators. He emphasized the fact that strength of generator insulation is the one missing link in the program of system protection. In closure, McCann asserted that under most adverse conditions of power-follow current the life of the Deion arrester is indicated to be about 20 years; the intervening erosion does not detract from the effective protection it affords.

Attitude toward the capacitor as a system tool has changed profoundly since the days described by H. E. Wulfing (Commonwealth Edison) as those in which "you were asked $30



F. R. Maxwell, U. S. Navy; H. J. Wyckoff, Detroit Edison; H. E. Wulfing and G. M. Armbrust, Commonwealth Edison Co.; A. C. Monteith, Westinghouse Electric & Manufacturing Co. (left to right)

C. Concordia, General Electric; J. G. Noest, Consolidated Edison; H. B. Seeley, Consolidated Edison, I. W. Gross, American Gas & Electric Service Corp.; H. R. Stewart, New England Power Service Co.; J. S. Parsons, Westinghouse; T. J. Brosnan, Buffalo Niagara Electric Corp. (left to right)

per kva. for a roll of tinfoil interleaved with delicate paper." But not so much as not to leave difference of opinion, as indicated by the discussion of R. G. Hooke (Public Service Electric & Gas). Hooke felt that the paper did not demonstrate that it is not good economy to fix on generators that have only enough reactive capacity to maintain stable performance. His company will continue to want 80 percent power-factor machines for the sake of their kilovars; they do not contemplate carrying all the lagging on capacitors alone. Overall cumulative annual charges are a better criterion than initial incremental investment; for that reason, the paper would have been more convincing if it had assumed a gradual load growth and correction over a ten-year period. The very attribute of movability of capacitors could then have been realized; also the heavy capacitor program advocated would not have been needed until near the end of the growth period, Hooke said.

Transmission and Distribution

Current Rating of Cables as Affected by Mutual Heating in Air or Conduit. I.P.C.E.A. Commitee on Research.

Tabulation of coefficients for various groupings. Based on program of E.T.L. tests using 1- and 4-in. conduit under conditions simulating free dissipation, side restriction but vertical dissipation and inclosure-restricting dissipation.

Calculation of Unbalanced Voltage Drops in Distribution Circuits with Particular Reference to Multigrounded Meutrals. W. R. Bullard, H. L. Lowe and H. W. Wahlquist (All Ebasco Services).

Assumptions result in simplified equations combining self and mutual impedances so that voltage-drop calculations are reduced to a single vector multiplication. Charts indicate typical end-effect values for 12 conductors up to 4 and more miles and one value of ground resistance.

Transformer Magnetizing Inrush Currents and Influence on System Operation. L. F. Blume, G. Camilli, S. B. Farnham and H. A. Peterson (all General Electric).

System disturbances need not be anticipated even for modern, improved-steel, high-density units. Harmonic restraint relays prevent differential tripping on inrush. Fuses should carry 12 times full-load current for 0.1 second without damage.

Costs Study of 69 to 345-kv. Overhead Power Transmission Systems. By John G. Holm (Boston Port of Embarkation).

Capital and annual costs, reduced to 1938–39 basis, compiled for 31 systems from 69 to 345 kv. and 50 to 800 mw., distances up to 500 miles; 345 kv. found more economical than 230 for more than 200 miles.

Correction factors in the cable report are much too conservative for high-voltage cables, according to A. F. Gambitta (Phelps-Dodge); on this point R. J. Wiseman, who presented the I.P.C.E.A. report, concurred, adding that the data were directly pertinent only for cables up to 12 kv., for power and industrial plants and commercial buildings. Wiseman also reassured Herman Halperin (Commonwealth Edison) on the matter of thermal resistance at the cable surface and again at the conduit; Halperin appreciated the usefulness of the coefficients but held that important jobs would have to be checked independently of them. W. A. Del Mar (Habirshaw Phelps-Dodge) explained how his studies made possible the reliable extension of the six groupings studied at E.T.L. to the 36 groupings covered in the report. In closure, Wiseman said he welcomed any contributions the industry would make toward expanding the scope of the explorations.

In response to a query, Wahlquist, one of the authors of the paper on voltage drop, explained that small steel conductors in conjunction with good grounding offer lower return resistance than large copper.

Magnetizing inrush is becoming an increasingly significant phenomenon impeding the co-ordination of fuses and breakers, said H. C. Louis (Baltimore) as well as complicating the task of setting the latter not to trip. That the authors are overoptimistic in their proposal to avert tripping by desensitizing the relays was the opinion of J. A. Elzi (Commonwealth & Southern); it is also important to have differential protection unimpeded just at the instant of energizing. His associate, W. R. Brownlee, felt that some of the expedients to circumvent inrush-tripping defeat the purpose of the relay protection. He emphasized the importance of retaining the inherent reliability of the transformer through the energizing interval.

Lightning, Fusing

Transmission and Relaying Problems on the Fort Peck Project. By Erik Floor (Harza Engineering Co.), **H. N. Muller and S. L. Goldsborough** (both Westinghouse).

Charging kva. (43,000) of 161-kv., 208-mile line exceeds generator rating (38,800 kva.); water-rheostat in lieu of surge tank; phase-angle discriminating relays; circular characteristic added to beam-type impedance relay.

Fusing Practices on Distribution Systems. By J. S. Parsons and J. M. Wallace (both Westinghouse).

Survey (168 utilities reporting) shows the following percentages: fuses used to protect systems, 80; protect transformer, 59; locate faults, 17; isolate, 16; inclosed indicating cut-out preferred, 70; repeating fused cutout used, 8; fusing secondaries, 12; cutouts for sectionalizing, 85. Fuse ratings average 5 A for 1½ to 50 A for 50 kva.

Reclosing of Single Tie-lines Between Systems. By W. W. Parker and H. A. Travers (both Westinghouse).

Calculations of over 100 system cases show that single-pole switching offers marked advantages in transient stability for two-wire-to-ground faults as well as the 70 percent of single-wire faults. Synchronizing power is maintained and voltage dips and system oscillations.

An Eight-Year Investigation of Lightning Currents and Preventive Lightning Protection on a Transmission System. By E. Hansson and S. K. Waldorf (both Pennsylvania Water & Power Co.).

Twenty-three basic conclusions drawn from study of 5,501 bracket records covering 13,227 tower-years, among them these: almost 5 to 1 variability in occurrence, mostly on shorter lines; most records are 5,000-10,000 amp., secondary peak 25,000-30,000 amp.; localized protection not justified; 6.4 percent more strokes recorded on four-bracket installations; tower-to-tower bonding helpful; single continuous counterpoise best; surge impedance of conductor in air indicated to be less than 235 ohms.

Great expectations of improvement in operation of tie lines arise from the development of single-pole relaying and switching. That was apparent in all the discussion of the Parker-Travers paper. H. N. Muller (Westinghouse) pointed out that "few practical cases would have inertial relations (between generating points) exactly corresponding" to the three cases treated in the paper. He presented a group of figures developed from information in the paper and from other data by means of which it became possible to interpolate between the conditions exemplified. C. E. Parks (Public Service of Indiana), from experience with single-pole switching, said that its values were as great for multiple as for single tie lines.

R. L. McCoy (Locke Insulator) wanted to know if the data presented in the Hansson-Waldorf paper permitted any conclusions as to the relative values of deep grounds and of counterpoises in sandy soil. Also, if Weather Bureau data on incidence of lighting could be combined with the record figures in the paper as bases for transmission line design in other regions. Some skepticism of the paper's conclusions was indicated by G. D. McCann (Westinghouse) because of the fact that the magnetic link instrument is not wholly reliable on certain large surges resulting from indirect lightning strokes. Also, the assumption of a one microsecond wave front made by the authors was questioned. E. R. Whitehead (Duquesne Light) suggested that application of certain principles of probability theory to the data of the paper might furnish a fair estimate of limiting stroke frequency.

The principal impression to be taken from the discussion of the Parsons-Wallace paper was that not enough is known about primary fusing and it is high time engineering study was given to the subject. All the discussors, R. H. Earl (Line Material), Frank Sanford (Cincinnati Gas & Electric), E. G. Newton (General Electric), J. B. Hodtum (Allis-Chalmers), George Van Antwerp (Philadelphia Electric) and others agreed on that. Questions raised in the discussion were mostly concerned with interpretation of the data presented in the paper. If the minimum size of fuse is raised, how much, if any, improvement in performance can be expected? Is the apparent limit of three fuses in cascade shown by a majority of the replies the result of difficulty in co-ordination or does it indicate a certain uniformity of system conditions? Are the differences in practices shown by the collected data the result of the change made a few years ago in fuse ratings or of shifts in operating practices?

Relaying Advances

The MHO-Carrier Relaying Scheme. By R. E. Cordray and A. R. Van C. Warrington (both General Electric).

Uses phase angle (rather than impedance magnitude) to distinguish between load and fault conditions so as to remove line from service only when systems swing so far apart that power cannot be transmitted.

The Functions of Ground Preference in Carrier Current Relay Schemes. By S. C. Leyland and S. L. Goldsborough (both Westinghouse).

Ground preference is definitely needed, when star currents are used in the phase relays, during flow of fault and load currents; but needed only, when using delta currents, in cases where fault current is all zero sequence and extreme load currents are present. Phase preference is better for systems subject to simultaneous grounds in different line sections.

System Voltages and Fault Currents Determined Easily on D.C. Board. By C. E. Asbury (Illinois Power).

Two networks used, one for positive-, other for zero-sequence components. Volt-

T. B. Hodtum, Allis-Chalmers; W. R. Brownlee, Commonwealth & Southern; Ivan Buys, Virginia Public Service; N. F. Rode, U. S. Naval Academy; W. C. Kalb, National Carbon Co.; H. W. Bibber, Union College (left to right)

meter reads percents directly. Conversion expressions given.

A Versatile Power Line Carrier System. By **H. W. Lensner** and **J. B. Singel** (both Westinghouse).

Separate audio tone for each function, permits simultaneous operation of several functions over a single carrier channel. Tone modulation rides through higher noise level. Filters separate tone and voice frequencies.

While the simplified method for calculating impedance circle diagrams disclosed in the Cordray-Warrington paper may be satisfactory for short lines, it was the opinion of C. A. Streifus (Ebasco) that exact calculations should be made for lines of 200 miles and more, particularly if the combinations of line and terminal systems can tolerate a comparatively high angular difference between transient internal voltages and still recover.

W. R. Brownlee (Commonwealth & Southern) asked some questions about the mho relaying scheme. What is the over-all tripping speed of the arrangement described? Are standard bushing potential devices entirely adequate for operation of the scheme? The paper states the scheme is applicable to all lines long enough to justify the cost of carrier-current relaying. How long is that?

Discussing the Leyland-Goldsborough paper, Oliver Ramsaur (Pennsylvania Power & Light) pointed out that removal of the ground over-current element from the carrier-stop circuit to prevent "in-between" operation in two-phase-to-ground faults is not a substitution of some other form of preference for ground preference, as might be inferred at first reading.

It is easy to gain the impression, commented F. M. Rives (General Electric) from a quick reading of the Lensner-Singel paper that any and all applications listed at the beginning of the paper can be handled by the same equipment. While this is entirely feasible, it may not necessarily be the most economical arrangement nor the most suitable from the standpoint of channel space conservation. Simple applications requiring only a few joint-use channels may be handled with simple equipment but more complev applications will need more complex equipment.

In considering such a system as described by Lensner and Singel, there are, said T. D. MacCoun (Link Radio) certain inherent limitations that must be taken into account. One is stability in which the frequency drift of the oscillator is not the only concern. There is also the drift in the tuned circuits of the tone filters. Another consideration is the ability of the system to discriminate against transient impulses produced by operations of circuit breakers, lightning arresters, etc.

Conference on Speed Relaying

Effect of Relay Operating Time on Damage to Equipment and Lines. H. R. Paxson, Philadelphia Electric Co.

Instances of trouble were cited to show the results obtained by certain kinds of relaying. In one case a large frequency converter was badly damaged by pulling out of step following a fault on the supply system. Profiting by this experience, out-of-step relays were developed and applied to the frequency converters. Then, when a similar fault occurred later on the supply system, the converters involved were cleared quickly and without damage.

Lack of high-speed differential relaying on a faulted bus caused a major system outage in one case described. In two other cases of trouble beginning in practically the same way differential relaying prevented the spreading of the trouble to the rest of the system. Other instances were given to show how fast clearing of faults affecting generating station buses will prevent or minimize damages and service interruptions.

Effect of Relay Operating Time on System Stability. R. C. R. Schulze, Public Service Electric & Gas Co.

This paper presented a brief but illuminating picture of how system instability develops in relation to speed of relaying. The quicker a disturbance is cleared from the system the quicker restoring forces can come into action; hence the value of high-speed relaying. Cases were those of line faults cleared by high-speed relays in ample time to prevent instability, cleared by slow-speed relays just before instability would occur and cleared by slow-speed relays too late to prevent instability. The effects of various factors on the problem were discussed—speeds of generating units, local loads connected directly to the generator, closely paralleled high and low speed machines, types and locations of faults and characteristics of system design.

Influence of High-speed Relays and Reclosing on Over-all System Performance. C. E. Parks, Public Service Co. of Indiana.

This paper contained information on performance of single-pole relay

C. L. Dudley, Public Service Electric & Gas; R. G. Warner, United Illuminating; E. J. Amberg, Conn. Light & Power; R. H. Van Horn, United Illuminating; H. B. Snow, Buhl & Caffrey; W. R. Van Steenburgh, Okonite; Dale Vernon, magician; S. G. Wingeld, Okonite

. E. Gischel, Walter Kidde Co.; Linwood Geyer, Ingersoll-Rand. R. T. Oldfield, Public Service Commission, N. Y.; W. J. Barrett, . J. Bell Telephone; J. L. Callahan, RCA Laboratories; L. Austin Wright, Engineering Institute of Canada; C. V. Christie, McGill University (left to right)

ng and switching on a 50-mile, 132-v. transmission line. "Staged fault ests and the meager experience (with ctual faults) that we have had with his installation in the past two years ndicate that it is a reliable and highly ffective means of combating the sta-ility problem." Another interesting art of the paper was the record of peration of a 73-mile section of 66-v. line built on wood poles, without static wire and protected by high-peed carrier-current relaying and hree-pole switching. In a 20-month eriod the line was in fault 131 times, nainly from lightning, and there were 110 successful reclosures. ight of the 131 operations were aused by permanent faults.

Concluding, he said: "We in the perating companies feel that much implification of the present carrier-urrent relaying schemes can be ade and we urge that steps be taken this direction as soon as is prac-icable."

Circuit Breakers

The Geometery of Arc Interruption, II; urrent Zero Phenomena. By E. W. Boehne (General Electric).

Operational attack reduces analysis to ear-constant solution of interruption rameters. Focus on "pendulum action" current. Large arc voltages conducive to duced recovery-voltage oscillations. Damp-g due to resistance and heterodyning tion.

A Magnetic-type Air Circuit Breaker for -Kv. Services. By L. J. Linde and B. W. yman (both General Electric).

Increase in thermal efficiency of inter-aving, serpentine-path arc chute affords owing electrical resistance of the arc and akes possible extension of "magne-blast" inciple to 15-kv., 250,000-kva. rating.

A 500,000-kva., 7.5-kv. Air Circuit Breaker r Steel Mill Service. By R. C. Dickinson (Westinghouse).

Magnetic diffusion principle applied to e from 50,000 kva. at 2.5 kv. to 500,000 kva. at 7.5 kv. Ample short-circuit interrupting capacity at 6.6 or 6.9 kv.

High-Voltage Oil Circuit Breakers for Rapid Reclosing Duty. By A. W. Hill and W. M. Leeds (both Westinghouse).

A 230-kv. breaker designed to utilize "Multi-flow De-ion Grid" contacts, capable of interrupting line charging current with minimum of restriking. Suitable for 20- and 35-cycle reclosing duty; more than 2,500,000-kva. three-phase duty.

A New Three-element Current-limiting Power Fuse. By H. L. Rawlins and H. H. Fahnoe (both Westinghouse).

Fast melting of element on high currents; gas-evolving material and quartz sand; metal vapors absorbed; non-inductive voltage-limiting resistor; boric acid clean-up fuse. Designed for protection of high-voltage motor starters and small loads on high-power systems.

Other than the customary comment by manufacturers on one another's papers there were few discussors. L. N. Grier (Aluminum Company) reported an excellent performance of the low-voltage General Electric breakers since the installation in 1939. He believes strongly in air breakers and would welcome a 13.8-kv. opportunity.

Commenting on the high-voltage Westinghouse breaker, Philip Sporn (American Gas & Electric Service), through H. P. St. Clair, welcomed the better effectiveness and smaller dimensions of the ingenious self-generating pressure type. He sees little reason to doubt the confirmation of laboratory results in field tests. He does not consider a 3-cycle objective too difficult to achieve and asked, why not aim at 12-cycle reclosure (relay, 1; breaker opening, 3; deionization and reclosure, 8) instead of the 20 and 35 cycles, even stretching to the 5,000,000 kva., which is not an unlikely eventuality. Sporn stated he has faith in the oil-poor or air types of breakers to fill the bill.

Rectifiers

A Short-Cut Method of Estimating TIF of Power Systems with Rectifier Load. By C. W. Frick (General Electric).

Presents curves based on average observed values; system resonance is neglected but inductive reactance at harmonic frequencies assumed. Takes beyond 72 phases, including most popular 36 phases.

Rectifier Circuit Duty. By C. C. Herskind (General Electric).

Separates rectifier circuit duty functionally from rectifier capacity to set up basis for rating all types of rectifying elements and setting forth the respective limitations.

Electronically Controlled Dry-disk Rectifier. By A. Rosenstein and H. N. Barnett (both Signal Engineering Products Co.).

Uses filter (with high a.c. attenuation, negligible d.c. attenuation and low-time constant) and amplification through thyratrons and saturable reactors to provide ½ percent voltage regulation of selenium-oxide rectifier; data for 24-volt, 100-amp. unit.

In emphasizing the approximations of the method (as acknowledged by Frick in the paper) H. E. Kent of E.E.I. mentioned the decreasing accuracy for lines long enough to introduce resonance. He cited a case of a 1,500-kva. six-phase rectifier fed by loop from 5- and 7.5-mva. sources, each 15 miles away, in which the Frick formula gave a TIF of 50, but on test gave 115; the system had a normal TIF of 15.

To a comment by J. H. Cox (Westinghouse) that interlaced windings must have lower reactance to give the same rectifier regulation, Herskind replied that they are, however, helpful in reducing fault current. He added that the zigzag commutates paralleled electrodes at different times and halves the regulation or can double the reactance for the same regulation.

Speed of voltage restoration of the electronically controlled dry-disk rec-

H. N. Muller, Jr., Westinghouse; G. E. Dana, New York State Electric & Gas Corp.; G. Steeb, Buffalo Niagara & Eastern Power Corp.; J. R. Stover, New York State Electric & Gas Corp.; L. J. Audlin, Central New York Power Corp. (left to right)

tifier was put in question by J. E. Yarmack (International Standard Electric) and others. The author named 20 to 40 cycles. W. Richter (Allis-Chalmers) pointed out that this was inevitable because of the high time constant of the many-turn d.c. winding of the saturable reactor fed from the thyratron plates; that was one reason why he would welcome something other than the almost-universal use of the saturable reactor to control a.c. by d.c. means. E. E. Moyer (General Electric) mentioned that saturable reactor also accentuates the harmonics unless the control ratio is advantageously chosen. In the case of Phanocharger the battery acts as a huge filter and greatly simplifies the harmonic problem.

Industrial Power

A New Electric Hoist Drive for Cranes. By **M. A. Whiting** (General Electric).

Ward Leonard system improved by addition of "cross-flux" exciter responsive to current in generator-motor "loop" circuit. Provides generator excitation and modifies motor excitation. Installation at Fontana Dam.

Heating of Non-magnetic Electrical Conductors by Magnetic Induction—Longitudinal Flux. By **R. M. Baker** (Westinghouse).

Derived formulas and charts show that 10,000 c.p.s. or less (rotating machine frequencies) are appropriate for pieces with minimum dimension of ½-in. or more, higher frequencies (tube or gap oscillators) for smaller sections. Thin-wall hollow cylinders act as short-circuited secondaries and can be heated more readily than the flat sheet.

Supervisory Control for the World's Most Modern Steel Mill. By **P. B. Garrett** and **M. E. Reagan** (both Westinghouse).

Conventional utility-system equipment applied to new 900,000-ton-per-year steel plant on Pacific Coast. Entire supply and distribution controlled by centrally-located power dispatcher. Each unit in 2½-square-mile plant also provided with entirely independent supervisory control set-up. There are 500 control points. D.c. used for reliability of control. Significant saving in experienced operators effected.

Electrical Equipment for the War Emergency Pipeline Projects. By **E. E. Thomas** and **W. G. Taylor** (both General Electric) and **Oscar Wolfe** (War Emergency Pipelines, Inc.).

Detailed description of motor and circuit protection, optimum switching of capacitors with motors, station sequence control diagram.

The Capacitor an Aid to Electric Power Service for Pipe Lines. By **M. A. Hyde** and **R. E. Marbury** (both Westinghouse).

Three sections of 720 (at two) and 360 kva. respectively at three of the Big Inch pumping stations with three 1,500-hp. motors giving a margin of 219 kva. for line correction. Four stations on Plantation line have similar capacitor banks.

"How may inductive heating be applied to liquid solutions?" was a question asked by L. P. Haner (Dupont) following presentation of the Baker paper. The problem of inductive heating, said W. G. Dow (University of Michigan) is essentially one of transformer design except that the given and the required quantities are different. The design must be built around a secondary fixed in material and shape. Power factor is not an important consideration since it does not extend back into the supply circuit. H. E. Somes (Budd Induction Heating) said that the principal difficulty in designing induction heating devices is to keep heat out of the primary, to confine it to the secondary where it is wanted.

It was the opinion of J. D. Leitch (Electric Controller & Manufacturing) that in eleven out of twelve crane applications there would be no need to depart from the usual one-motor drive in favor of the five pieces of rotating equipment described in the Whiting paper.

Comment on the Hyde-Marbury paper by W. H. Stueve (War Emergency Pipelines) was to the effect that use of capacitors at electric services to pipe line pumping stations was simply an expedient for improvement of voltage and could not be justified as a contribution to reduced operating cost. Capacitors are installed, he said, at only four out of the 29 stations on war-emergency pipe lines.

Conference on Industrial Power Applications

Inverter Action on Reversing of Thyratron-Motor Control. By **H. L. Palmer** and **H. H. Leigh** (both General Electric).

Rectifier, functioning as inverter, decelerates by regeneration, then, as rectifier, accelerates in reverse; motor armature current held practically constant throughout, at less than rated amperes; motor stopped quicker than plugging.

Experience with Short Circuits and Breakers, with Emphasis on Co-ordination between Fuses and Breakers. L. C. Peterman, Ford, Bacon & Davis. This paper dealt with circuits of 600 volts and less and with short circuits and low resistance grounds caused by defective or damaged equipment. Utility engineers have grappled with the fault problem on high-voltage circuits and, employing relays and oil and other breakers, have accomplished much in securing selectivity of operation. Yet in the low-voltage field, where direct-acting breakers having inherently better operating speed than any relay-breaker combination, no real attack has been made on the problem of obtaining selectivity and co-ordination of operation.

The largest single cause of short circuits in industrial plants has been poor workmanship in installing wires and cables. This is particularly the case in plants recently built. In general, a combination of a breaker backed up by a fuse is not satisfactory. It is wise to limit the number of breakers in cascade to two, three at the most, and adjacent breakers in cascade should differ in size by at least a two to one ratio, more if pos-

ible. The most urgent need in low-voltage breakers is adjustable trip ratings for all types. The next is true and dependable selectivity, coupled with high-speed tripping by direct-acting mechanisms.

Dodge Chicago Plant's Distribution Scheme with Airplane Engine Power Recovery Circuits. E. L. Bailey, Chrysler Corp. The great diversity of production operations, each with its characteristic requirements of electric service, makes the problem one of assembling and assaying a great mass of detail. The final step is straight addition resulting in a sum that the engineer hopes will turn out to be fairly close to the measured load when the plant gets into full production.

Induction Heating Applications. Howard E. Somes, Budd Induction Heating, Inc. Out of the development work and the experience that form the technical background of what is thought to be the largest induction heating installation in the world—consisting of 62 special type heaters powered by 7,200 kw. in motor generators supplying energy at 3,000 and 9,600 cycles—comes certain conclusions about the heating equipment.

The device that must withstand the greater punishment is the inductor which is the essential tool. It is usually water-cooled. Its size and shape are determined by the geometry of the piece to be heated. Copper of high conductivity, excellent insulation and expert design and workmanship are necessary to give the tool the life and the low maintenance cost needed to satisfy mass production requirements. Superior means of mechanical chucking, of quenching, of all production operations, are necessary to insure that the heat will be properly produced and applied and as properly extracted, at the same time avoiding any possible accidental contact between the work and the inductor. Every effort must be bent toward making a foolproof device. And a sturdy, positive switching device must be provided to interrupt the high-frequency circuit.

The best comment on this group of papers made no direct reference to their content. It was offered by J. A. St. Andre (Wright Aeronautical Corp.), who announced that this was the best institute session he had ever attended because it was concerned with matters within the interest and the comprehension of the average electrical engineer in industry. He opined that the institute should give more attention to the use and operation of electrical equipment and less to the complex mathematics of its design.

J. B. Miller and E. A. Leinroth, Electric Service Supplies

On the subject of the Peterman paper, A. P. Schnyder (Geo. F. Hardy Co.) said that one of the best reasons for preferring fuses to breakers in industrial applications was that a machine operator must wait for the electrician to replace a fuse but can reclose a breaker himself—and thus, perhaps, do a lot of damage. B. M. Jones (Duquesne Light) pointed out that the process characteristics of various plants must influence decisions as to breakers and fuses.

The widening field of application of induction heating is requiring some very remarkable work in mechanical design and craftmanship, said Comfort A. Adams (Edward G. Budd Mfg. Co.), for example, a precision tool of only a few cubic inches in which is concentrated 300 kw. of electric power.

G. W. Thaxton, REA and C. C. Crane, FPC

Electrical Measurements

A Multiplied-Defection A.C. Potentiometer. By **R. B. Marshall** (Purdue University).

Null balance, portable, field-work unit based on indicating instruments measures high and low impedance.

An Instrument for the Measurement of Large Alternating Currents. By **Walter Richter** (Allis-Chalmers).

Air-core transformer wound on flexible core affords linkage without disturbing measured circuit. Electronic circuit resolves and integrates the pickup for oscillographic study. The lead from one end is brought back along the axis of the toroid.

Crossed-coil Power-factor Meters. By **N. P. Millar** (General Electric).

Gives scale-design formulas for single- and polyphase meters. Graphs of torque relations and equilibrium equations are given to assist in fixing scale distribution.

Influence of Improved Magnetic Alloys on Design Trends of Electrical Instruments. By **M. S. Wilson** and **J. M. Whittenton** (both General Electric).

Thin instruments with sturdiness, improved factor of merit, increased range of sensitivity obtained by use of internal pivot and resort to high-coercive, high-residual comol (12 Co, 17 Mo.).

Discussion of the Marshall paper turned out to be a series of suggestions of ways to replace the cathode-ray oscilloscope used by the author as a null detector. P. A. Borden (Bristol Co.), E. D. Doyle and A. J. Williams (Leeds & Northrup) and Walter Richter (Allis-Chalmers) each offered other and different devices for the purpose.

Paul MacGahan (Westinghouse) pointed out that the title of the Millar paper was in error since the instrument it dealt with is a phase-angle, not a power-factor, meter. This same point was raised by Borden, who referred to a European form of power-factor instrument which actually measures that ratio irrespective of polyphase load balance or unbalance.

In reference to the Wilson-Whittenton description of new magnetic alloys, Mr. MacGahan inquired as to the cost advantage of using the new alloys in ordinary instrument construction over the scheme of soft iron pole pieces attached to chromium steel magnets. He asked for more information on the "age-hardening" method employed and on its possible effect on the dimensions of the finished magnet.

Old and New U-1 Compared

Paragraph by paragraph comparisons of the two latest versions, except where no real changes are made, are given below. Letter-number groups in parentheses indicate the paragraph designations of the respective orders

September 24, 1943, Version	January 22, 1944, Version
Operating supplies are material essential to supplying electric power which is generally carried in inventory and charged to operating expense accounts (a-7-i); material for an addition to or expansion of property in which total material cost does not exceed $1,500 underground or $500 for other construction (a-7-ii); material for maintenance, repair and operating supplies includes only that essential to minimum service standards and none for improvement (a-8).	Operating supplies means material other than fuel, water treatment material, etc., which is used or consumed in the course of a producer's operations, except in maintenance, repair and plant additions (a-10).
(a-7-ii)	Plant addition means the construction or installation of new facilities or the replacement of existing facilities with facilities of greater capacity (a-6).
(a-7-ii)	Minor plant addition means a plant addition having a net material cost of not more than $1500. No subdivision allowed (a-7).
none	Major plant addition is one having a net material cost of more than $1,500 (a-8).
Inventory is all new or salvaged material not incorporated in plant, excluding appliances, merchandising supplies and material segregated for construction (a-11).	All material except that in plant, merchandising supplies and appliances, fuel, water treatment material, etc., material for use in approved major plant additions and scrap is considered inventory (a-11).
AA-1 automatic rating assigned to purchase of other than controlled material to be used, or to replace material used, for maintenance, repair and operating supplies other than erection of a line to consumer premises (b-1). Material to be used, or to replace material used, for a line to consumer premises gets an AA-3 automatic rating for other than controlled materials (b-2).	AA-1 automatic rating for other than controlled material in all except transmission and distribution class when the material is for MRO use or for a minor plant addition (b-1). AA-1 automatic rating for transmission and distribution equipment, other than controlled material, to repair an actual or imminent breakdown (b-2). AA-3 automatic rating for transmission and distribution equipment, other than controlled material for MRO use or for minor plant additions (b-3). Material obtained with an AA-1 rating may be used for lower-rated purposes, but may only be replaced by applying the lower rating to an equivalent dollar value in the same class. Material obtained on an AA-3 rating may be applied to a higher-rated use and replaced with either rating. This paragraph supersedes Priorities Reg. 1 (b-4). Ratings for major plant additions obtainable on Form WPB-2774 unless ratings are automatically assigned under orders U-1-h or similar supplementary order (b-5).

Old	New
Preference ratings may not be applied or extended: to obtain material which could be eliminated without serious loss of efficiency (c-1); to obtain material available without ratings, (c-2); to obtain any item in violation of Priorities Regulation 3 (c-3).	Maintenance or repair jobs involving replacement may be done without regard to the dollar value of material provided: the job is necessary to maintain or restore service at minimum standards or to prevent damage to facilities (h-1); design emphasizes economy of manpower and material, (h-2); no serviceable facility or part thereof is replaced except to avoid imminent breakdown (h-3). Plant additions may be performed without specific permission where a net material cost does not exceed $1,500 and no serviceable facility or part thereof is replaced except to avoid imminent breakdown ((i-1); design emphasizes economy of manpower and materials (i-2); new facilities are necessary to render service at minimum standards (i-3); no extension to consumer premises is made or connected unless authorized by supplementary U-1 order or by approval of an application on Form WPB-2774.
No utility shall schedule for delivery in any calendar quarter any rated or unrated material for MRO use whose aggregate dollar value exceeds 1/3 of the aggregate dollar value of material in the same class withdrawn from inventory for such use during the last nine months of 1942 (f-1).	No utility shall schedule for delivery in any calendar quarter any material for MRO use or for minor plant additions unless the dollar value of such material together with the dollar value of all material in the same class which has been scheduled for delivery for these uses in the same calendar quarter does not exceed the quota established in Schedule B. Quotas for producers whose inventories exceed $10,000 in value are computed by determining a base quota. Base quota in any class is the dollar value of withdrawals in that class for MRO use during the last 9 months of 1942. Utilities have a quota for Class 1 materials of 4/3 of the base quota increased proportionately to the increase in system output in the year preceding the current year over output in 1940. Classes 2, 3, 4, 5, 6 and 7 have a quarterly quota of 1/3 the base quota, (e-1 and Schedule B). (Class 1 is on an annual basis.)
No utility may accept delivery of rated or unrated material for MRO use if its inventory in the same class is or will become in excess of a practical working minimum (f-2).	No utility shall schedule material for delivery in any calendar quarter for MRO use or for minor plant additions unless it does not have reason to believe that its inventory in the same class is or will become in excess of the practical working minimum (e-2).
No utility may withdraw in any calendar quarter material for MRO use whose aggregate dollar value exceeds 1/3 of the aggregate dollar value of withdrawals in the same class for such uses during the last nine months of 1942 (f-3).	No restrictions on withdrawals

Old	New
Notwithstanding provisions of paragraphs f-1, 2 and 3: a utility may in any calendar quarter increase scheduled deliveries and withdrawals of generating station material over prescribed limits in proportion to the increase in system output in the 12 months preceding the current calendar quarter over system output in 1940 (f-4-i); a utility may withdraw consumer meters in any calendar quarter in an amount not exceeding 1/3 of the meters or regulators condemned and destroyed in the last 9 months of 1942, plus enough to serve the net increase in customers in the current quarter (f-4-ii); a utility may in any calendar quarter schedule for delivery or withdrawal from inventory material necessary for the maintenance or repair of equipment which is damaged (f-4-iii); a utility may in any calendar quarter schedule for delivery material in any class whose aggregate dollar value is not more than the dollar value of material in the same class delivered from inventory to other persons, but only when such taking has reduced the utility's inventory in that class below PWM (f-4-iv); a utility may withdraw from inventory material whose aggregate dollar value is not more than the dollar value of useable material in the same class salvaged from plant during the current quarter (f-4-v); a utility may in any calendar quarter increase the dollar value of materials withdrawn for MRO use provided adjustments are made in the withdrawals of other calendar quarters of the same year so that total withdrawals for the year do not exceed the allowable withdrawals for that year (f-4-vi); no utility's PWM for meters shall exceed 50 meters plus 1¾ percent of the meters installed in his system on the first day of the preceding quarter (f-4-ix).	Restrictions of paragraph (e) do not apply to utilities whose inventory does not exceed $10,000 in value except such utilities must restrict inventory to that amount which is considered the smallest quantity with which wartime service at minimum standards can be furnished (f-1); restrictions of paragraph (e) do not apply to material excepted from inventory by paragraph a-11 (f-2); if a utility sells material to another utility from its PWM for repair of a breakdown, it may schedule additional deliveries for replacement of such material (f-3); if a utility's property has been damaged it may schedule deliveries to the extent necessary to repair the damage (f-4); WPB may establish specific delivery quotas and limits for permissible inventory for individual utilities, modifying provisions of Schedules B and C (f-5); restrictions of paragraph e-1 do not apply to material scheduled for delivery from the utility's own excess inventory or that of another utility (f-6).
Notwithstanding provisions of any priority or other order, except a directive referring specifically to this paragraph, no utility shall schedule for delivery or accept any controlled material in Schedule B for construction if its usable stocks of this material are or will become in excess of the dollar value of such material if estimated will be required on authorized construction during the 60-day period succeeding the scheduled delivery date of such material, or the actual delivery date, whichever is the later (g-1); notwithstanding restrictions of g-1, a utility may accept deliveries of controlled material for construction under circumstances stated in paragraph (c) of the CMP Regulation 2 (g-2).	No restrictions. Controlled material scheduled as other material under paragraph (c).
No utility shall construct an addition to or expansion of property and no utility shall, for contract construction, accept material unless: such addition or expansion is specifically authorized by WPB (h-1-i); such addition or expansion is an extension less than 250 ft. long (including service drop and any portion built by or for a consumer) of a line to serve a new building where the foundation was completed prior to July 1, 1942 (h-1-ii); such addition or expansion requires material whose dollar value is less than $1,500 underground and is not an extension of a line to consumer premises, provided that no job shall be divided and that such addition requires only material essential to minimum service standards and does not replace usable material with material of a better kind, quality or design (h-1-iii); no utility shall connect with a line built by or for a consumer or prospective consumer which, at the date of its completion, exceeded restrictions of this order applicable to lines constructed by or for the utility without specific authorization by WPB to construct a line of substantially identical specifications to serve such customer (h-2).	A minor plant addition may be done, provided: serviceable facilities or parts thereof may not be replaced except to avoid an imminent breakdown (i-1); design emphasizes economy of manpower and material (i-2); new facilities are necessary to render service at minimum standards (i-3); and no extension to consumer premises is made or connected unless authorized by a supplementary U-1 order or approval of an application filed on WPB-2774 (i-4). No material can be used for major plant additions unless the job is authorized by a supplementary U-1 order or by approval of an application on WPB-2774 (j).
Materials which are scarce and whose use could be eliminated without serious loss of efficiency by substitution of less scarce material with but little change of design shall not be used (c-1). Also, material for MRO use includes only material essential to minimum service standards and does not include material for improvement of utility property or equipment through replacement of material usable in existing installations with material of a better kind, quality or design (a-8).	Materials must be necessary to maintain or restore service at minimum standards (h-1). Design must emphasize economy of manpower and material as well as the substitution of the more plentiful for the scarce material (h-2), and no facility or part serviceable in its existing installation may be replaced except to avoid an imminent breakdown (h-3).
No utility may sell material from inventory except as follows: any sale which is a special sale of industrial material under Priorities Regulation 13 as determined may be made as therein provided. Utilities may make a special sale of industrial material to other utilities to fill orders rated AA-5 or better or pursuant to a WPB directive (i-1); any sale of material not under Priorities Regulation 13 may be made subject to restrictions of Orders L-31, L-94 and L-102 (i-2); to fill orders bearing preference ratings of AA-3 or higher (i-2-i); pursuant to specific written direction by WPB, (i-2-ii); to persons who produce or from whom the utility purchased such material, in the form it was purchased (i-2-iii); to a scrap dealer as scrap (i-2-iv); to a used equipment dealer for resale if the item is used and is not listed in Schedule D of this order (i-2-v); to the Army, Navy, Maritime Commission or public housing authority for repair of an actual threatened breakdown. This exception shall not apply to a sale of material for use in construction (i-2-vi).	Utility may sell material in its PWM or excess inventory, or that acquired for major plant additions, only in accordance with the following rules: to any person with an AA-5 rating or better unless it is controlled material (k-1); to any person without a preference rating if the aggregate dollar value of all sales to that person in the current quarter does not exceed $100 and the material is not controlled material (k-2); to fill an authorized controlled materials order if it is controlled material (k-3); pursuant to a specific written direction from WPB to the seller or purchaser (k-4); to the person who produces such material, or person from whom it was purchased in its present form without preference rating or allotment number, (k-5); to a scrap dealer as scrap without priority (k-6); to a used equipment dealer, if it is used equipment, without priority (k-7); to the Army, Navy, Maritime Commission or a public housing authority for repair of actual or threatened breakdown without priority or allotment number (k-8); restrictions on sales in Priorities Regulations 1 and 13 do not apply to sales by utilities under this paragraph (k-9); and provisions of Orders L-94, L-196 and L-102 must be observed. (k-10).

Editorials

S. B. WILLIAMS, *Editor*

Voluntary and Democratic Standards

AS THE old year was coming to a close the American Standards Association was celebrating its twenty-fifth anniversary. It is a proud record that A.S.A. has hung up in the past quarter of a century—more than 600 approved American standards. But better than mere numbers is the fact that A.S.A. has come to be a symbol of public acceptance.

This public confidence was earned because of the methods used in approving a standard. Every group that has a primary interest, including the public and labor, is given ample opportunity to be heard, and no standard is put through until all basic objections have been cleared up. Regardless of how large or influential the sponsoring body is, A.S.A. procedure is democratic.

This is the greatest asset that A.S.A. has. Sometimes it seems as though a standard would never get through, yet it is always better in matters of this kind to take too long than to be too hasty.

In the period after the war the demands for standards will be much greater, principally because of the necessity for elimination of waste in order that more production can be made available for less money. Many old standards will be challenged in the light of war experience. Because of the pressing need of such work there is the probability of public impatience at the slowness of the operation. It might be well, then, to review the procedure and dispense with such red tape as serves no important and useful function, but no step should be eliminated which protects the integrity of the standards or insures the democracy of the system.

During the next quarter of a century we shall find the path of civilization greatly altered economically and socially as the result of the war. One of the possibilities is a greater dependency on standard methods. After the last war many peoples had standards forced on them by government edict. The same economic forces may be at large in this country after the war, but it is hoped that we may continue to make standards of our own choosing—voluntarily and democratically as with A.S.A.

All-Industry Association

CANADA is to be congratulated for taking the lead in making plans for an all-industry association to promote the use of electricity. While the idea originated with the membership of the Canadian Electrical Association, it is expected the participation will be by both public and privately owned power systems. No plans have been drawn up other than that a council of the industry will formulate a program in time for announcement at a national meeting of dealers late in March.

Promotion of electric service is not something that belongs to the utilities and promotion of appliances something else that belongs to the dealers and their suppliers. The two go hand in hand and for that reason should be co-ordinated. The customer is the same and his use of one depends to a large degree on how well the other serves him.

If everybody that has a stake in the residential electrical market were to work together as a team, there would be much more accomplished. Teamwork recognizes mutuality of interest and breeds confidence and respect.

Perhaps the idea can spread across the border.

Army Opposes General Relaxation of Material Limitations

FOR THE TIME BEING, at least, any thought of a general relaxation of limitations on materials for civilian production must be held in abeyance. While there is a growing surplus of many kinds of raw materials and some easing in the labor situation, the military does not think it wise to return to peacetime pursuits, at least until the invasion has progressed closer to success.

There is no longer any question about having enough war supplies, but there is a big question of public psychology. For one thing, any substantial return to civilian supply production might easily cause a large migration away from war work into more permanent employment.

While the military is in control of policy for the moment, it is not improbable that a political showdown might be demanded by organized labor if any widespread unemployment results from cut-backs.

However, civilian supplies are recognized as being of different degrees of essentiality, and for that reason certain civilian production limitations might be relaxed long before others. Among these are equipment for utilities.

This doesn't mean that utilities will be permitted to go ahead with large plans for post-war system development, but it does mean that a start can be made on any deferred maintenance that needs attention. Speaking at Chicago last week, Edward Falck, deputy director of OWU, said that his office was prepared to authorize the purchase of transmission and distribution equipment to take care of weak spots on particular systems.

However, because it isn't possible yet to generalize on these relaxations it will continue to be necessary to get authorizations. This is a much simpler procedure since the new U-1 was put into effect. Much of the paper work has been eliminated, the procedure simplified and the oper-

ons liberalized, as will be seen in the comparative study ontained in this issue.

Some civilian relief has already been granted in releasing materials for certain limited production of electrical appliances. With the military opposed to production for civilians of goods of this general order it would not be wise to count on any expansion in appliance supply for some time.

In fact it is likely that civilian production will remain a *status quo* until some one is willing to take the responsibility of opposing the military during war.

Poster Space on the Customers' Walls

WHAT would the poster space be worth on the living room walls of the homes of all the electric customers in the country? Would the industry like to have on these walls a targeted reminder of electric service, its readiness at all times and some realization of the unseen wiring over which the service comes?

We are reminded by Reddy Kilowatt that the target is there in the form of the convenience outlet, out of which electric service comes, and the wall switch, which gives instantaneous service. And so a new program which will cover nearly half the wired residences of the country will symbolize the wiring as well as the service with the slogan "Plug-in . . . I'm Reddy!"

Isn't this what the electrical industry has been looking for—something to personalize the unseen wiring, to hook the wiring to the service? So far Reddy Kilowatt has been the electrical servant, the ready-to-serve electrical energy. Now Reddy becomes something more. He becomes the representative of everything that goes to make convenient as well as dependable electric service. He now is the agent of the electrical industry.

Renegotiation and State Regulation

ANY HOPES for utility exemption from renegotiation of power contracts in states having public utility regulation were destroyed by the Senate when it rejected such an amendment to the tax bill.

Utilities now find themselves in many cases between two opposing regulatory forces, one to renegotiate specific contracts which have earned more than such loads would normally earn, and the other to find a way of returning excess profits to customers, primarily residential customers.

The Senate was told that the Federal Power Commission had handled so far 156 contracts under the President's "cheapest power" directive, that another 123 are now under active consideration and that the commission has 530 such contracts on file.

It is apparent therefore that it will be some time before all of these contracts can be renegotiated, and in the meantime some commissions are getting restive. Which will take precedence, renegotiation or commission regulation? Will renegotiation be figured by the contract or on an over-all excess return basis?

So far no pattern for renegotiation has been announced. Will each procuring agency conduct its own renegotiation or will it work through FPC? If each agency does its own work, will there be any standard procedure? Some of these questions must be made known if utilities and state commissions are to know where they stand.

Prefabrication Lamp Announcements

AROUND the first of the year the fluorescent lamp manufacturers announced that circular lamps would be made as soon as manufacturing conditions permitted and this week they go a step further and say that small diameter fluorescent tubes will be made as soon as they can get around to it. This is rather unusual because none of these lamps are now available, not even as samples for the trade. There are some laboratory samples with which the manufacturers are working, trying to learn more about them, and that is about all.

Nevertheless, the manufacturers have let fixture designers know that these lamps will be available so that they can plan their fixture design without having to rush at the last minute. This is going to be particularly helpful to manufacturers of lighting equipment for the home, where, except for utility areas, fluorescent lighting was not well adapted because of fixture design and appearance limitations.

The effort to use straight tubes in portables has not met with great success, with the result that there has been an increasing demand for shapes. The circular lamp is an answer to this need.

While it has always been known that circular lamps could be made, there has been a sort of passive resistance to their manufacture during the five years that we have had fluorescent for two reasons: First, manufacturers had their hands full taking care of a mounting demand. Second, it was felt that shapes were more difficult to standardize and it would be easy once shapes were introduced for them to get out of hand and a very serious replacement problem to ensue.

The manufacturers haven't stated how they propose to handle that situation so that interchangeability of renewals, one of the big advantages of lamps so far, can be continued. Since the new lamps won't be available for some months, there is still time to effect a standardization that will make it easy for the customer to make replacements.

Whatever other reasons may have prompted these revelations at this time, the lamp manufacturers are to be commended for these early announcements because of the help they give to dealers selling lighting equipment and to the utilities, who can now assure their customers that certain kinds of equipment will be available and do some pre-victory selling.

Washington Comment

By R. N. LARKIN, Washington Correspondent

Substantial Improvement in Coal Situation

DESPITE whatever outrage it may have worked upon the sensibilities of the public at large and the War Labor Board in particular, the contract memorandum negotiated with the United Mine Workers of America by Coal Mines Administrator Harold L. Ickes last November to end the year's fourth coal strike has the one rare virtue of having resulted in substantially increased bituminous coal production at a time when extra coal was vital.

So substantially has it done this that some informed government men are not now particularly concerned about whether there will be coal for electric power in 1944. The concern has shifted rather to how well the supply of coal can be distributed and to what extent it will be possible to rebuild depleted stockpiles this year.

Assuming Strikeless 1944

This relative lack of concern as to whether there will be coal at all is predicated, of course, on the assumption that 1944 will be a strikeless year in the coal pits. How valid this assumption may be is not currently a subject for discussion by these men, who have no control over the coal mine labor situation. Their attitude seems to be that an apparently acceptable solution has been worked out and that the probabilities are that no one wants a strike or wants to strike. On that basis, with their fingers crossed and a fervent prayer for a strikeless year lending what support it can, they assume that production will not be so paralyzed this year.

If it is a strikeless year, the situation shapes up about as follows: Anticipated outside demand for bituminous coal from U. S. pits in 1944, 620,000,000 to 640,000,000 tons. Production which may justifiably be expected, 625,000,000 to 650,000,000 tons. It is agreed that the higher figure in each case is distinctly less apt to be the true one.

Bituminous coal production had shown an increase of 500,000 to 1,000,000 tons over the comparable week of the previous year in each of the first ten weeks the contract memorandum had been in effect. In eight of those ten weeks the production was substantially above the average which was mined in 1943's strike-free periods—slightly under 12,000,000 tons weekly. The other two weeks saw heavy slumps, attributable to the year-end holidays, when coal production traditionally declines. In not all of the weeks under the new terms has the production been as high as many people consider could be expected, but during several weeks' production has risen to heights which prove that substantial weekly gains can be expected from the new terms, provided nothing operates to destroy their attractiveness.

More Coal Under New Terms

First full week under the new terms, the week ended November 20, saw bituminous production rise to 12,700,000 tons. Thereafter the figures were as follows: November 27, 12,450,000 tons; December 4, 12,650,000 tons; December 11, 13,050,000 tons; December 18, 12,210,000 tons; December 25, 9,450,000 tons; January 1, 10,500,000 tons; January 8, 12,250,000 tons; January 15, 12,750,000 tons, and January 22, 12,650,000 tons. Thus it is apparent that while the new terms are not producing 13,000,000 tons of bituminous a week, they are bringing aboveground substantially more coal than the old terms.

If it is granted that the new terms can bring weekly production up to 12,500,000 tons throughout the year —and many set the reasonably expectable weekly figure even higher—50 weeks' operation, again barring strikes, would bring in 625,000,000 tons of coal, or about 6,000,000 tons more than was used during 1943, when 589,000,000 tons were mined and about 30,000,000 came off stockpiles. This would leave only a small margin for rebuilding stockpiles, but a margin of 15 to 20 percent of the amount by which stocks were drawn down in 1943.

Reluctant Stock-Piling

Some Washington officials wonder concerning the matter of rebuilding stocks, whether there would be the same drive to pile up coal in the yards this year as there was in 1942 even if all the coal that could possibly be handled were available. They argue that the war production which required these huge stocks was just getting started in 1942, that industries knew they could use it all and knew that transportation and coal itself would get progressively tighter as the war program boomed ahead. Now, they argue, the war program is over the hump, with an increasingly steep downgrade in sight. On this basis they doubt that many companies will be inclined to stockpile as vigorously as they did in 1942. The validity of this argument is obscure, but it is obvious from the cutbacks already made that the profusion of war contracts which led coal users to believe they could profitably stock large amounts of fuel in 1942 no longer exists.

The matter of foreign requirements, placed by some officials at about 15,000,000 tons for 1944, also is obscure. Admittedly if 15,000,000 tons for export were piled on top of a 630,000,000-ton domestic demand for 1944, the coal situation could continue to be critical. But until justification for foreign demand figures is made and until it can be demonstrated that additional production cutbacks will not equalize these demands or more, the foreign demands are not a too great worry.

On one point there is little qualification or hedging. These men see little if any increase in the amount of fuel oil available for generation in 1944. Admitting that widespread use of fuel oil would allow real coal economy, they point to the impending second front and the repeated promises of far broader action in the Pacific during 1944 as conclusive evidence on this point.

NEWS OF THE WEEK

Upholds FPC's Right to Remove Write-ups

Supreme Court upholds right of Federal Power Commission to order removal of write-ups from utility plant accounts — May also prescribe the method

The Supreme Court this week upheld for the first time the right of the Federal Power Commission to order the removal of write-ups from utility plant accounts and to prescribe the method in which such write-ups shall be removed.

1942 Order Affirmed

The high court affirmed an order issued in April, 1942, directing the Northwestern Electric Co., serving customers in Washington and Oregon, to amortize a $3,500,000 write-up in common stock by charges to annual earned surplus, the charges to be equal to net income less preferred stock dividends. Justice Roberts delivered the unanimous decision. Northwestern Electric has been joined in its appeal from the Circuit Court decision affirming FPC's order by its parent company, American Power & Light Co. It pleaded that the FPC order was invalid because of exceeding the commission's statutory authority and because it was in violation of the "due process" and "states' rights" amendments to the Constitution.

"The commission's power to prescribe a uniform system of accounting and to require Northwestern to keep accounts accordingly is not open to doubt," the decision said in part . . . . "The only inquiries now open are whether the order as to the disposition of the $3,500,000 item . . . . goes beyond the commission's statutory mandate or constitutional limitations. We hold that it does neither.

"In the light of the admitted fact that there has been a write-up of $3,500,000 on the asset side of the accounts to balance a stock liability created by the company in the same amount, which represents no value received for the stock issued, any accounting which limits plant items to their actual value when and as required demands that this write-up be eliminated from the accounts . . .

"The question is whether the write-up must be written off the books in some manner. Northwestern says it should not be, but it offered no evidence before the commission to show that in accounts based upon cost any such item should appear in plant account or elsewhere. There was expert evidence by the commission's witnesses that it must be eliminated. Nevertheless, the petitioners insist the commission's order as to disposition is arbitrary . . .

"Although the commission's prescribed method of eliminating the write-up may not accord with the best accounting practice, it is sustained by expert evidence. It is not for us to determine what is better practice so long as the commission has not plainly adopted an obviously arbitrary plan . . ."

The court held that the constitutional objections "are without merit and need but brief notice," adding:

"That the comission's action prevents the company from redressing the deficiency of paid-in capital by entering among its assets appreciation of value subsequent to the issue of the common

UTILITY BUYERS GROUP OFFICERS — At the recent Chicago meeting of the National Association of Purchasing Agents, Utility Buyers Group, are: Ben R. Newbery, president, N.A.P.A.; M. B. Covell, Union Electric Co., utility group chairman; J. R. Millikan, Dallas Power & Light, secretary-treasurer, and Thomas I. Anderson, Acme Steel Co., president Purchasing Agents Association of Chicago

stock takes nothing from the company or the stockholders . . .

"Nothing in the statute or the order prevents Northwestern keeping other accounts if it so desires which will give information with regard to estimated present appreciated value of its assets . . .

"The commission's order does not violate the reserved rights of the states under the tenth amendment. We are not here concerned with what the regulatory authorities of Oregon or Washington may or may not demand or permit. Whatever that action may be, it is subordinate to Congress' appropriate exercise of the commerce power. The commission's order does not purport presently to affect or constrain action by the states within their fields."

Suggestions Refused

The original FPC order, issued in December, 1940, was the first directing the elimination of write-ups, and directed the application of net income after preferred dividends to elimination of the $3,500,000 write-up. The commission subsequently granted a rehearing only on disposition of the write-up, in which the company refused any suggestions as to disposition. The Ninth Circuit Court of Appeals upheld the order without ruling on disposition, which was then under rehearing. On reaffirmation of the order the company sought further review by the Circuit Court, which was denied, and the case went to the high court on a writ of certiorari.

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Indiana Utility Plan Approved by FPC

The Federal Power Commission announced last week its approval of proposals by the Public Service Co. of Indiana, Inc., Indianapolis, to eliminate from its utility plant accounts a total of $14,238,289.65, representing remaining excess of purchase cost over original cost of utility properties acquired, affiliated company profits remaining in utility plant accounts and other items. The company's proposals reflect, the order of approval states, the conclusions and recommendations of the FPC's and Indiana Public Service Commission's staffs. The disposition of amounts totaling $5,789,830.12 is to be effected principally through charges to reserve for depreciation and other reserves, created through appropriations of surplus, and the amount of $8,448,459.53 will be amortized over a period of not more than 15 years ending in October, 1958.

Utilities Program Must Await War Developments

Adjustment of utilities programs for 1944 by the War Production Board must await future military successes — OWU plans order simplification and control relaxation as additional resources become available

Adjustment of utilities programs for 1944 by WPB must await future military successes; however, concrete future plans are being laid by OWU for simplification of orders and relaxation of controls as additional resources become available, Edward Falck, deputy director of the OWU, said in Chicago last week.

Falck's Message

"In passing out of the period of severest stringency, it is clear that we should return as soon as possible to normal operating practices in the utility field," Falck told the Public Utility Buyers Group of the National Association of Purchasing Agents, meeting in Chicago.

"When we reach the stage when we can go some percent of the way back to peacetime conditions there is no question," he said, "but that government will attach a high priority to the return of utilities to normal operations."

"While we are not yet prepared to ease inventory controls throughout the country, we are prepared to increase allowable quotas on the West Coast because of special demands that may be imposed on utilities in that area during the next year or two," Falck stated. Similarly, while OWU is not prepared to authorize purchase of switching, substation, transmission and distribution facilities on a peacetime basis, Falck indicated that OWU is willing to authorize acquisition of this type of equipment to care for weak spots which may have developed on particular systems.

"To the extent that there has been any deferred maintenance, efforts should be made this year to initiate needed rehabilitation. On the other hand, extravagant plans for post-war system development should be held back for the present," Falck said.

OWU, it was stated, is at work on revision of basic orders along two lines; simplification and relaxation. Simplification is being undertaken in the form of orders and their administration. Relaxation of control must await military successes and reduced military procurement. OWU has developed several programs for using additional materials by relaxing present restrictions on utility equipment and construction. These, however, will be held in abeyance until materials and man-hours can be properly devoted to less essential purposes than at present.

For Order Clarity

Paul B. Valle, administrator of U-1 for OWU, in discussing the recent (January 22) revision of this order, said the prime purpose of the change was a rearrangement and rewording of the order for clarity. In it, quantitative restrictions on withdrawals from inventory and controls on "acceptance of delivery" have been eliminated. To stimulate the redistribution of excess inventories between utilities the new order no longer makes it necessary to count as a "scheduled delivery" material from a company's own excess inventory or from the excess inventory of another company.

With rate relief from high post-war taxes and labor costs improbable for utilities, H. V. Erben, G. E. central station department manager, saw standardization of heavy equipment as a way to reduce capital investment and show a saving. Channeling of purchases into a small number of equipment types and ratings selected to meet the majority of needs would, he said, bring (1) lower price levels; savings varying from 2½ percent to 20-30 percent, depending on the number of standard ratings; (2) greater power system flexibility through ability to shift standard apparatus around the system; (3) fewer replacement stocks due to interchangeability of parts, and (4) more time for engineers to study power system design instead of searching catalogues.

Must Rebuild Stock Piles

"Given manpower and equipment necessary to get coal out of the ground, there will be no shortage of coal in 1944; failing that, however, the coal situation for this year is not so good," John Battle, executive secretary of the National Coal Association, told the utility buyers. Taking the country as a whole, Battle stated, there would have been enough coal in 1943 had it been equitably distributed. As it was the national stockpiles saved the situation. Battle urged the utilities to start now to rebuild their stockpiles and to rebuild them as rapidly as possible.

War Labor Board Orders Frantz Re-employment

Myles Frantz, whose disciplining by P. P. & L. last August led to ineffectual strike at two plants, ordered re-employed at old job by NWLB — Loses three months pay

Myles Frantz, whose disciplining by the Pennsylvania Power & Light Co. last August led to an ineffectual strike at two P.P.&L. plants by the non-recognized Utility Workers Organizing Committee (CIO) last December, was ordered re-employed at his old job with the loss of three months pay last week by the National War Labor Board.

Lost Two Months Pay

Frantz, who was directed to return to work Saturday by the contract-holding Employees' Independent Association, whose settlement of his case he had spurned, appeared to be the only loser, since the terms on which he was ordered re-employed cost him two months more pay than had originally been assessed against him. President John Thomas of EIA said he did not know whether Frantz returned to his job as a boiler room operator at P.P.&L.'s Pine Grove plant Saturday.

Both Thomas and President John S. Wise, Jr., P.P.&L. president, expressed approval of the settlement. Thomas said an EIA local meeting at Pine Grove January 28 accepted the settlement and was "elated" that the grievance machinery established in the EIA-P.P.&L. contract, which WLB discarded against all precedent in taking jurisdiction of the case, had been recognized as binding in the matter and valid for any future grievances. Wise said the company's paramount interest in the case had been the validation of the existing contract, which the board did.

Public WLB Member Wayne L. Morse and the four industry members dissented from the order, which gives Frantz back pay from November 6 to January 25.

Pine Grove and Hauto UWOC locals struck both plants unsuccessfully for four days in December, returning to work when WLB discarded the grievance machinery of the existing contract and heard the Frantz case on its own merits.

No Precedent Established

WLB reemphasized in its decision that its consideration of the Frantz case outside the contract machinery does not establish a precedent "nor shall it be considered in any way as changing the established policy of the board that all grievances should be settled in accordance with the grievance machinery provided for in the collective bargaining agreement between the company involved in the particular case and the recognized bargaining agent." It was this provision which satisfied EIA and P.P.&L.

"Involved in this case," the board asserted, "were found the long and faithful service of Frantz (20 years), his neglect of his duties on the job in this case, his failure to use the grievance procedure in the collective bargaining agreement between the company and the recognized union, the inexcusable and reprehensible strike in Frantz' behalf by the unrecognized union and the fact that Frantz urged the strikers to return to their jobs.

"In view of the fact that this is the first disciplinary action taken by the company against Frantz, the board will not direct that Frantz be demoted from the position held by him at the time of his suspension.

"This action by the board maintains the right of the company to take disciplinary action in the event of any further neglect of his duties by Frantz. In case of any future disciplinary action the case may be taken up as a grievance by Frantz in accordance with the grievance procedure and arbitration provision, if necessary, in the existing agreement between the company and the recognized bargaining agent, subject to the provisions of the National Labor Relations Act."

Industry members and Morse dissented vigorously, saying in conclusion:

"The violation of the no-strike pledge was flagrant, callous and arbitrary, and neither union nor worker should be permitted to acquire any advantage of any sort as a result of such tactics."

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Bond Issue Authorized

Quebec Public Service Board has authorized the St. Maurice Power Corporation, a subsidiary of the Shawinigan Water & Power Co., to issue a further $100,000 of second mortgage bonds at 99½. A further issue of $100,000 was authorized to cover expenditures in 1944.

JOINT MEETING LUNCHEON—Office of War Utilities Inventory Control Branch representatives at lunch during joint meeting in Chicago last week with the Utility Buyers Group of the National Association of Purchasing Agents

Craig Takes Stand in REA Investigation

Robert B. Craig, former deputy administrator of the REA, takes the stand to deny allegations made against his conduct by earlier witnesses — Clash between witness and counsel

In what quickly developed into a contest between witness and counsel, Robert B. Craig, former deputy administrator of the Rural Electrification Administration, took the stand before the Senate agriculture subcommittee investigating REA this week to deny many of the allegations made against his conduct by earlier witnesses.

Clash Frequently

Committee Counsel Carroll L. Beedy told the committee that Craig might be on the stand as long as four days. Beedy and Craig clashed almost constantly throughout the first two days over questions posed by the former for which "yes or no answers" were generally sought. On numerous occasions Beedy directed the official reporter to strike comments by Craig. Second-day testimony went far afield from matters earlier covered, and as this issue of ELECTRICAL WORLD went to press Craig had not had any opportunity to reply to many allegations against him by earlier witnesses, although he had emphatically denied the truth of many other allegations.

Craig Testimony

Craig opened his first-day testimony with the statement that he had been awarded the highest existing civil service rating in every year of his federal employment that such ratings were made.

After attempting unsuccessfully to put into the record a 27-page, highly detailed statement in reply to previous testimony concerning his activities with REA, Craig, under questioning by Committee Counsel Carroll L. Beedy, flatly denied many of the individual allegations against his official conduct earlier put into the record.

He denied ever having outlined a plan for a political and purchasing organization to encompass all REA co-operatives with John A. Becker, former Wisconsin REA official, and denied having met Becker under the circumstances outlined by the latter in the "Becker memorandum" testified to earlier (ELECTRICAL WORLD, December 8, 1943, page 3). In the statement refused admission to the record, Craig labeled the Becker memorandum "wholly imaginary and a tissue of lies." Craig told the committee he "did not consider Becker a man of integrity . . ." and denied that he had ever said he intended "to control REA from inside or outside."

In a tangled bit of testimony which saw numerous complex questions proposed by Beedy and protested as not susceptible to "yes or no answers" by Craig, the witness first differentiated between REA participation in co-op purchases of line materials and of household or farm appliances. There was never any REA participation in purchase of the latter to his knowledge, Craig said, adding that he never had planned to establish any organization for such function. As regards line materials, he went on, REA served as "central organization" for co-ops which, individually prohibited from maximum discounts under the Robinson-Patman Act because their individual purchases were insufficient to qualify, sent their requirements to REA, which pooled them and received bids based on the total requirements of all co-ops, thus qualifying for vastly higher discounts under the Robinson-Patman Act. Craig said the process was "within the law," that it did not entail REA acting as agent for co-op purchases and that the reduction in line costs from $1,100 per mile in 1939 to $750 per mile in November, 1941, indicated the efficacy of the program in REA's over-all drive to cut costs and thus reduce the price of electric energy to farmers, as the REA act requires.

Under questioning by Sen. Guy Gillette, Iowa Democrat, Craig testified that he was "pretty sure" that co-ops were formally advised that they were not required to buy if, after having had their bids pooled by REA for discount purposes, they choose not to go along with the resultant low bid. The pooling system, he said, was operated by Clarence Winder as "head of operations," whom Craig described as "one of the most capable engineers I ever knew."

Craig succeeded in putting into the record an exhibit attached to his rejected statement in which Carmody wrote that:

"It seems to me naming you (Craig, as acting administrator) will cause less interruption with business (of REA) than any other action at this time." He said he offered the exhibit in refutation of earlier testimony that Carmody had considered him not sufficiently competent to become administrator.

Memorandum Into Record

In testifying on the long-standing, intra-REA dispute between copper and aluminum for co-op conductor, Craig also got into the record a memorandum dated June, 1938, purporting to have been sent to the current REA administrator by 20 signatory U. S. Senators. The document read in part:

"Therefore, as Senators from states which produce copper or manufacture copper products, we do respect fully request that, in order to carry out the expressed intent of Congress in the expenditure of rural electrification funds, you specify the use of copper conductors and equipment."

Included in the names at the bottom of the document were those of Senators Hayden, Guffey, Chavez, Hatch, Vandenberg, Truman and McAdoo. The reference to the "expressed intent to Congress" was to the fact that REA funds were supposed to be so spent as to encourage employment, and copper mining and fabricating gave broad employment in 24 states.

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Will Add Thin Tube Fluorescent Lamps

Lamp manufacturers announced this week the addition of thin tube fluorescent lamps to their line just as soon as manufacturing conditions permit. This announcement, as well as that of circular fluorescent lamps, is made now to enable fixture manufacturers and others to plan their designs.

There are four lamps in the thin tube line, three 5½-ft. including sockets ranging from ½ to 1 in. bulb diameter, and one 6½ to 8-ft. which will be ¾ in. Transformers will be available for operating these lamps in series and other suitable ballast equipment, together with sockets, will be designed for the voltages involved.

The announcement states that not only are no production facilities available now, but no definite date been set for producing these new lamps, nor can samples be furnished.

The chief advantage of the thin tube, it is stated, will be in display and show case lighting. "Because of its additional length," the announcement says, "it will be better adapted to many special types of lighting than the more usual size of fluorescent lamps."

$56,000,000 Reduction in TVA's 1944 Budget

Tennessee Valley Authority voluntarily lops $56,000,000 from its budget for the fiscal year beginning July 1 — FPC and SEC ask greater appropriations for overtime payments

The Tennessee Valley Authority voluntarily lopped almost $56,000,000 from its budget for the fiscal year beginning July 1, but the Federal Power Commission and the Securities and Exchange Commission asked for greater appropriations for the next year, basing their requests principally on the necessity for overtime wage payments.

Allows Current Financing

Following its procedure of last year, TVA sought no new appropriations, but asked that unexpended balances of earlier appropriations be made available, along with current receipts totaling $87,791,180. This would allow financing of current obligations totaling $77,134,882, a reduction of $2,000,000 in funded debt and an unobligated balance of $8,656,298, which would be available for any deferred projects which might be released by the War Production Board. Chairman David E. Lilienthal told the Hous appropriations subcommittee on independent offices that if any widespread resumption of construction were authorized, TVA would have to ask for a supplementary appropriation. TVA will have an unobligated balance of $19,262,298 June 30 and current receipts of $68,528,882. The committee approved the request in its report to the House.

FPC sought $2,774,500, an increase of $305,245 over its appropriation for the current year, which was recommended by the committee in its report principally because the extra funds are for overtime wage payments.

SEC asked $4,902,000, an increase of $858,000 over its appropriation for the current year, but the committee recommended only $4,696,704, cutting $205,296 from the request. Of the additional funds, $630,750 was sought for overtime wage payments. Another $59,800 was asked to finance original cost studies required under the commission's Rule U-27 promulgated about two years ago.

Chairman Lilienthal of TVA told the subcommittee that "there is no expansion or no new projects or programs contemplated in this 1945 estimate." He said that the current budget winds up major construction in the development of the Tennessee River, and that the pending 1945 budget "mops up that construction." Power operations, he went on, will provide $36,307,515 of the $68,528,882 current receipts for 1945 financing. General Manager Gordon R. Clapp told the subcommittee that TVA anticipates a personnel total of 12,000 or less when construction is concluded.

Chairman Leland Olds of FPC claimed considerable credit for the adequacy of power for war production when he told the committee that:

"I think the commission's work, beginning particularly in 1938 and coming down to the period when WPB had built up very considerable staffs at the end of 1941 and 1942, was the real explanation of the adequacy of power supply for the war effort. I make that statement not solely on my authority as a member of the commission but also base it on a statement made by Mr. Krug of WPB . . . in which he indicated his belief that it was the preliminary work of the commission through 1941 which enabled the country to meet the war production effort without a shortage of power."

EDISON MEDAL PRESENTATION—Dr. Vannevar Bush (right), president of the Carnegie Institution of Washington, receiving the 1943 Edison Medal from Dr. Nevin E. Funk (left), president of the American Institute of Electrical Engineers, at the annual winter technical meeting of the Institute in New York last week

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Free Enterprise in Science Urged

Americans may look forward to new comforts and pleasures in the post-war period if scientists and industrialists are allowed to work in a society giving full opportunity for initiative and individual enterprise, Dr. Vannevar Bush, president of the Carnegie Institution of Washington, told more than 1,000 engineers assembled in New York last week at the winter technical meeting of the A.I.E.E.

Dr. Bush, who is also director of the Office of Scientific Research Development of the Office of Emergency Management, received the 1943 Edison Medal of the A.I.E.E. "for his contribution to the advancement of electrical enginnering, particularly through the development of new applications of mathematics to engineering problems, and for his eminent service to the nation in guiding the war research program".

The medal was presented to Dr. Bush by Dr. Nevin E. Funk, president of the A.I.E.E., at the general session of the convention of the institute. Dr. Frank B. Jewett described the medalist as one of America's outstanding scientists.

Dr. Bush declared that the output of American laboratories and factories had outstripped even the most hopeful expectations, in equipping the mightiest fighting force in our history. He pointed out that this achievement alone was proof that free enterprise is superior to regimented society and pleaded with Americans to preserve this freedom in the post-war world.

Bargaining Committee Appointed by A.I.E.E.

Following ratification early last month by members of the American Society of Civil Engineers of the action taken by its board of direction permitting local sections to act as collective bargaining agents for engineers (ELECTRICAL WORLD, January 29, page 4), the board of directors of the American Institute of Electrical Engineers last week voted to appoint a committee to study conditions affecting security of employment and compensation among electrical engineers with special reference to collective bargaining.

The board's resolution also requested the committee to collaborate with a corresponding committee of the American Society of Mechanical Engineers "if such a committee is appointed." The resolution further authorized the employment of a labor relations adviser and appropriated a budget of $1,000 to cover expenses incurred.

Text of the resolution follows:

Resolved: "That the President be authorized to appoint a committee to study broadly the conditions affecting security of employment and compensation among electrical engineers, with special reference to problems of collective bargaining; that this committee be requested to collaborate with a corresponding committee of the A.S.M.E. if such a committee is appointed; that the committee be authorized to employ a labor relations adviser, if it considers this advisable, and that it be granted an appropriation of $1,000."

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Large Post-war Need for Illuminating Engineers

Although post-war construction and conversion will demand trained illuminating men in larger numbers than ever before, only three colleges said they are now giving courses in the principles of illuminating engineering, according to a survey among 100 colleges and universities completed recently by the F. W. Wakefield Brass Co., Vermilion, Ohio, manufacturer of lighting equipment.

The survey was conducted to determine the top man in each school's illuminating engineering class who will be sponsored by the company into the Illuminating Engineering Society in an effort to bring fresh viewpoints into the profession and also to encourage undergraduate engineers to consider this field.

Comment on the survey, among members of the faculties in engineering schools responding to the queries, was favorable, however, and T. D. Wakefield, vice-president of the company conducting the survey, has been assured that the illuminating course will continue to be offered to students.

MEETINGS

Edison Electric Institute—Annual commercial meetings, Edgewater Beach Hotel, Chicago, Ill., April 3-5. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

American Society of Mechanical Engineers—Spring meeting, Hotel Tutwiler, Birmingham, Ala., April 3-5. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York 18, N. Y.

Missouri Valley Electric Association—Engineering conference, Continental Hotel, Kansas City, Mo., April 6-7. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln 8, Neb.

National Association of Corrosion Engineers—Annual conference, Rice Hotel, Houston, Texas, April 10-12. O. C. Mudd, acting secretary-treasurer, c/o Shell Pipe Line Corp., Box 2648, Houston 1, Texas.

Electrochemical Society—Spring meeting, Hotel Pfister, Milwaukee, Wisc., April 12-15. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York 27, N. Y.

Midwest Power Conference—Palmer House, Chicago, Ill., April 13-14. Stanton E. Winston, director, Illinois Institute of Technology, Chicago, Ill.

Missouri Association of Public Utilities—Annual meeting, Jefferson Hotel, St. Louis, Mo., April 19-20. Jesse Blythe, assistant secretary, 101 West High St., Jefferson City, Mo.

National Electrical Wholesalers Association—Second war conference, Stevens Hotel, Chicago, Ill., April 19-22. C. G. Pyle, managing director, 500 Fifth Ave., New York 18, N. Y.

National Electrical Manufacturers Association—Spring meeting, Palmer House, Chicago, Ill., April 24-27. W. J. Donald, managing director, 155 East 44th St., New York 17, N. Y.

Previously Listed

Edison Electric Institute—Prime movers committee, Copley-Plaza Hotel, Boston, Mass., February 7-8; accident prevention committee, William Penn Hotel, Pittsburgh, Pa., February 11-12; electrical equipment committee, Netherland Plaza Hotel, Cincinnati, Ohio, February 14-15; transmission and distribution committee, Netherland Plaza Hotel, Cincinnati, Ohio, February 14-15. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

Pennsylvania Electric Association—Transmission and distribution committee, Benjamin Franklin Hotel, Philadelphia, Pa., February 10-11; M. M. Devorris, chairman, Pennsylvania Edison Co., Altoona, Pa. Electrical equipment committee, Roosevelt Hotel, Pittsburgh, Pa., February 17-18; A. N. Shealy, chairman, Pennsylvania Water & Power Co., Lexington Bldg., Baltimore, Md.

American Society for Testing Materials—Symposium on plastics, Philadelphia, Pa., February 22-23; spring meeting and committee week, Netherland Plaza Hotel, Cincinnati, Ohio, February 28-March 3. Robert J. Painter, assistant secretary, 260 S. Broad St., Philadelphia 2, Pa.

Great Lakes Power Club—Winter meeting, Palmer House, Chicago, Ill., February 25. R. P. McClellan, secretary, Consumers Power Company, Grand Rapids, Mich.

Council of Electric Operating Companies—Annual meeting, Palmer House, Chicago, Ill., March 9. Tom P. Walker, president, Homer Bldg., 13th and F Sts. N. W., Washington 5, D. C.

North Central Electrical Industries—Second war conference sponsored by electrical trade groups, St. Paul Hotel, St. Paul, Minn., March 26-28. W. A. Ritt, secretary-manager, 234 Foshay Tower, Minneapolis, Minn.

Electric Sign Group Elects First Officers

After three months of preliminary work the National Electric Sign Association was formally organized last month. A group of thirty-nine charter members, including electric sign manufacturers and their suppliers, met at the Palmer House in Chicago, adopted a constitution and elected officers and directors. Headquarters have been established at 224 South Michigan Avenue, Chicago, Ill.

A well-rounded program was set up which would not only cope with today's problems but would develop activities to meet the challenge of post-war sign business. Activities on subjects relating to the electric sign industry will be undertaken as circumstances dictate.

Officers elected to serve the first year were: President, John Aull, Swanson-Nunn Electric Co., Evansville, Ind.; vice-president, Harry Parker, Flashtric Sign Works, Chicago, Ill.; secretary-treasurer, George C. Kirn, Jr., G. C. Kirn Adv. Sign Company, St. Louis, Mo.

Maurice R. Ely was selected as executive secretary to direct the activities of the association. Mr. Ely spent seventeen years with the Electric Association, in Chicago and was secretary-treasurer of the Electrical Maintenance Engineers and the West Suburban Electric League. For the past year he was a lighting sales engineer with Sylvania Electric Products, Inc.

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Permits Write-Ups To Be Eliminated

Last week the Federal Power Commission announced its approval of proposals by the Gulf States Utilities Co., an Engineers Public Service Co. subsidiary, to eliminate from its plant accounts amounts totaling $5,693,671.76, representing write-ups and other excesses over original costs. The company's proposals, the order of approval states, embody all the adjustments recommended by the commission's staff.

The disposition of $2,786,523.69 is to be effected through charges to earned surplus and reserve for depreciation and the remaining $2,907,148.07 will be amortized over a 15-year period, ending in 1957, through equal monthly charges to miscellaneous amortization, with concurrent credits to reserve for amortization, provided that the company may at its option accelerate the charges and credits by utilizing certain anticipated tax savings.

Output Declines Slightly to 13.8%

The output curve declined slightly for the week ended January 29, 1944, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry during the week came to a total of 4,523,763,000 kw.-hr., as compared to the figure of 4,531,662,000 kw.-hr. for the week previous, which ended on January 22, 1944. Figures for the week, however, represented an increase of 13.8 percent over the 3,976,844,000 kw.-hr. distributed during the corresponding week a year ago. Figures for the similar week two years ago were lower, the total being only 3,468,193,000 kw.-hr. for that period.

Again, however, all of the major geographic regions of the country reported increases for the week over corresponding weeks a year ago. The Pacific Coast region led the field with an individual gain of 30.8 percent. In second place, with a gain of 15.8 percent, was the Southern States region. The Rocky Mountain region took third place with a gain of 12.0 percent. Low region for the week, with a gain of only 5.6 percent, was the New England region. The individual gains or losses over the preceding week for this year were varied, according to the report, but the greatest individual increase occurred in the New England region, which gained 2.4 percent over the preceding week.

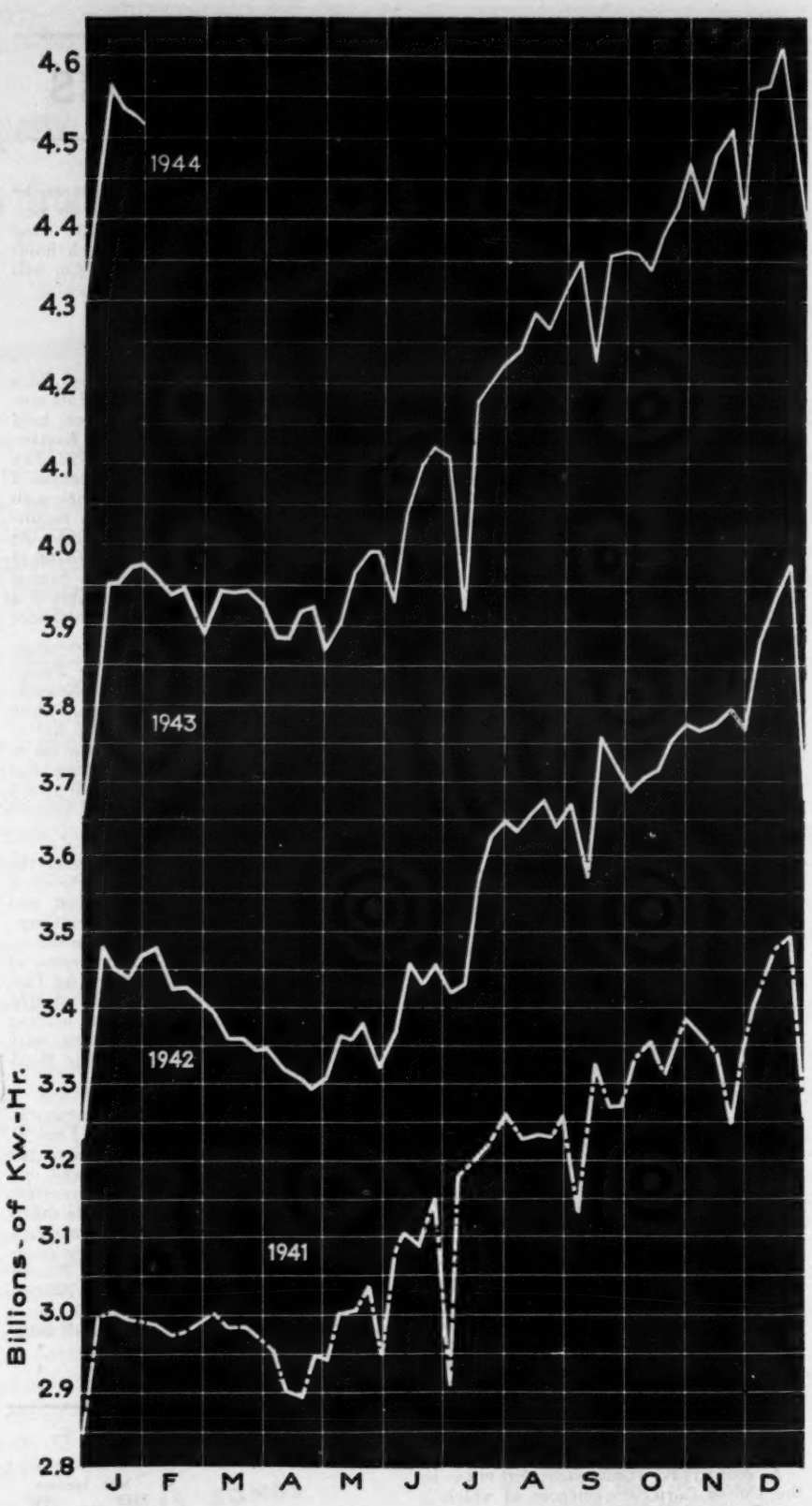
Weekly Output, Millions Kw.-Hr.

1944		1943		1942	
Jan. 29	4,523	Jan. 30	3,976	Jan. 31	3,468
Jan. 22	4,531	Jan. 23	3,974	Jan. 24	3,440
Jan. 15	4,539	Jan. 16	3,952	Jan. 17	3,450
Jan. 8	4,567	Jan. 9	3,952	Jan. 10	3,473
Jan. 1	4,300*	Jan. 2	3,780	Jan. 3	3,289
1943		1942		1941	
Dec. 25	4,295	Dec. 26	3,656	Dec. 27	3,234
Dec. 18	4,612	Dec. 19	3,975	Dec. 20	3,495
Dec. 11	4,566	Dec. 12	3,937	Dec. 13	3,475
Dec. 4	4,560	Dec. 5	3,883	Dec. 6	3,414
Nov. 27	4,403	Nov. 28	3,766	Nov. 29	3,339
Nov. 20	4,513	Nov. 21	3,795	Nov. 22	3,247
Nov. 13	4,482	Nov. 14	3,776	Nov. 15	3,348

Percent Change from Previous Year

	Week Ending		
	Jan. 29	Jan. 22	Jan. 15
New England	+ 5.6	+ 3.2	+ 5.3
Mid-Atlantic	+11.9	+13.0	+14.5
Central Industrial	+ 9.1	+ 9.9	+10.3
West Central	+ 5.8	+ 6.2	+ 6.4
Southern States	+15.8	+16.7	+17.4
Rocky Mountain	+12.0	+11.5	+12.8
Pacific Coast	+30.8	+29.4	+29.9
Total United States	+13.8	+14.0	+14.8

* Subject to revision.



Energy Production Rises 14.6% in December

Electric energy produced for public use in December totaled 19,952,123,000 kw.-hr., an increase of 14.6 percent over production in December, 1942, the Federal Power Commission reports.

Average daily production of electric energy for public use in December was 690,385,000 kw.-hr., a new high level and and increase of 1.0 percent over average daily production during the previous month. Production by water power in December amounted to 5,574,197,000 kw.-hr., or 27.9 percent of the total output for public use, the commission stated in its report.

Utility Coal Consumption

Electric utility power plants consumed 7,782,551 tons of coal in December, the Federal Power Commission reports. Coal stocks of electric power plants as of January 1, 1944, were 6.5 percent less than stocks of the same date last year, the report indicates.

SEC DECISIONS-HEARINGS

The Securities and Exchange Commission, in a series of orders issued last week affecting electric utility companies:

EXTENDED from December 31, 1943, until June 30, 1944, the time in which International Utilities Corp. may purchase $1,942,500 principal amount of Dominion Gas & Electric Co.'s 6½ percent collateral trust bonds. International had purchased all but $139,000 worth by December 31, it reported to the commission.

PERMITTED THE American and Foreign Power Co., Inc., to refund $35,000,000 of indebtedness to its parent, the Electric Bond and Share Co. by the payment of $5,000,000 in cash and the issuance of $30,000,000 of 3 percent serial notes. The new notes and the cash would redeem the overdue 7 percent note for $35,000,000 of Foreign Power, dated February 14, 1935, now bearing interest at 6 percent. The plan, as app. ved, superseded an earlier proposal to pay the $35.000,000 notes in full. Unfavorable reaction on the part of some stockholders, in addition to complex problems which that program would raise, made it inadvisable to press it at this time.

ANNOUNCED IT WILL HEAR oral arguments, if requested, on the right of the Department of Justice to participate in the proceedings brought by the commission to review disciplinary action by the National Association of Security Dealers, Inc., against certain of its members. The disciplinary action grew out of alleged violation of the price-maintenance provisions of the syndicate agreement in connection with the offering, late in 1939, of bonds by the Public Service Co. of Indiana.

Applications Filed

FLORIDA POWER CORP. has registered $16.5 million first mortgage bonds series due January 1, 1974, to be offered under the commission's competitive bidding requirements. The interest rate on the bonds and the offering price to the public will be supplied by post-effective amendment.

A STATEMENT IN CONNECTION with proposal of Consolidated Electric & Gas Co., parent company, to offer for sale under the commission's competitive bidding rule 400,000 shares of Central Illinois Electric common stock, par value $15 per share. Names of underwriters, offering price to the public and spread will be filed by post-effective amendment. Consolidated owns all the common stock of Central Illinois and is disposing of its interest in compliance with the holding company act.

A VOLUNTARY REORGANIZATION PLAN by the United Corp., the purpose of which is to effect compliance with the "death sentence" provisions of the holding company act. This includes a proposal by the top holding company to exchange for each outstanding share of its $3 cumulative preference stock and the rights to accrued dividends on such shares up to and including 1,244,356 shares, $3.75 in cash, 1½ shares of Philadelphia Electric Co. common stock and one-fourth share of Delaware Power & Light Co. common. Consummation of the plan will result in the reduction of United's holdings in Philadelphia Electric common stocks fom 2,022,074 to 155,540 shares, or about one and one-half percent of the outstanding voting shares of the latter company. All of United's common stock holdings in Delaware Power & Light Co. will be disposed of.

Hearings Scheduled

FEBRUARY 10: Niagara Falls Power Co.'s request to reduce the stated value of its outstanding no par value common stock, held by its parent, Buffalo, Niagara and Eastern Corp., from $35,575,565 to $21,077,797. The reduction is asked in order to create a capital surplus account in compliance with Federal Power Commission orders requiring elimination of $14,500,574 from its plant account. The FPC said $14,497,768 of this amount might be charged to capital surplus rather than to earned surplus if a capital surplus was created and the charge made before March 1, 1944.

FEBRUARY 15: Proposal by the Public Service Co-ordinated Transport, Newark, N. J., to purchase from its parent, Public Service Corp. of New Jersey, $455,000 of miscellaneous bonds for $353,871 and up to $4.000,000 of its own 4 percent first and refunding mortgage bonds due 1990 at not more than 100 percent of principal amount plus interest.

FEBRUARY 15: An amended plan of the Laclede Gas Light Co., Laclede Power & Light Co., and Phoenix Light, Heat and Power Co., subsidiaries of the Ogden Corp., the purpose of which is to effectuate the reorganization of Laclede Gas, to dispose of the electric utility assets operated by Laclede Electric to Union Electric Co. of Missouri and to enable the Ogden holding company system to comply, in part, with provisions of Section 11 (b) of the Holding Company Act.

FEBRUARY 15: Proposal of the American Utilities Service Corp. to sell to Fred D. Ellis of Chicago, Illinois, 95,000 shares, par value $5 per share, of the issued and outstanding common stock of Northwestern Illinois Utilities, an electric and gas utility company and a subsidiary of American, together with the unsecured 6 percent promissory note of Northwestern dated November 1, 1938, and due November 1, 1964, in the principal amount if $375,000. for a cash consideration of $840,000 with interest from January 1, 1944.

MARCH 13: Montana Power Co.'s hearing originally scheduled for January 31 to determine accounting adjustments to be made by the firm, a subsidiary of American Power & Light Co., the commission also changed the place of the hearing from Washington, D. C., to a place in Montana to be designated later.

Utility Reports

	Net Income 1943	1942
*Alabama Power	$4,481,802	$4,141,077
*Cons. Gas Elec. Lt. & Pwr. (Balto.) and sub.	6,346,687	6,178,285
†Electric Power & Light and subs.	8,618,238	8,800,394
*Georgia Power	6,176,773	5,594,630
*Iowa Public Service	670,076	767,539
†National Power and Light and subs.	5,555,552	5,218,947
*Ohio Edison	3,299,462	3,161,051
*Sioux City Gas & Elec.	654,571	618,358
*Tampa Electric	1,188,827	1,130,890

*Twelve months ended December 31.
†Twelve months ended November 30.

South Tucson Votes Huge Bond Issue

The small community of South Tucson, Arizona, on the outskirts of Tucson, voted last week, 122 to 15, to issue $9,500,000 in bonds for the purchase of the Tucson Gas, Electric Light & Power Co., which its neighbor rejected last October 29.

Mayor Walter L. Ellis stated before the results of the vote became known that if the purchase were authorized his city would become tax and license free and that consumers, including residents of Tucson and the wide desert area surrounding it, would receive a 14 percent reduction in rates.

It was pointed out, however, that two hurdles are still ahead for the young municipality:

Tucson has filed condemnation proceedings against the utility to guard against its falling into South Tucson's hands.

The Securities and Exchange Commission has not ordered the parent, Federal Light & Traction Co., to divest itself of the Tucson property. Until it does the utility may not be for sale.

Wyoming System Earnings

The Kendrick, Wyo., project power system, of which the power plant at Seminoe Dam is the main unit, earned about $350,000 last year after deducting operating costs and a replacement reserve. Earnings will be applied to the construction cost of the Kendrick reclamation project, the first unit of which will produce for a development of 35,000 acres of farm land.

Utility Windup Approved

At a special meeting of shareholders of Porto Rico Power Co., Ltd., held January 25, a resolution submitted for winding up the company and distributing its assets was unanimously approved. The winding-up step follows sale of the operating subsidiary's assets to the Peurto Rican Government, as announced last week.

How One Power Company Got Another 100 Kw from an Overloaded Feeder for a New Airport

PROBLEM. A small airport in the South needed 2300-volt service, the total estimated peak demand being 100 kw. The power company that serves the area had a 2300-volt distribution feeder, but it was already loaded to the point of causing trouble. This feeder originated at a substation on an 11-kv circuit at a point about 15 miles from the generator.

SOLUTION INCLUDED USE OF INDUCTION REGULATORS. In order to carry the new airfield load, the company extended the 11-kv feeder about 4¼ miles, to a point where the 2.3-kv feeder branched and continued in two directions. At this point, three G-E 75-kva transformers and *TWO G-E 12-KVA 2400-VOLT INDUCTION REGULATORS* were installed. The regulators not only made it possible to supply the airfield with the power required, but also improved voltage conditions on the two 2300-volt branch lines.

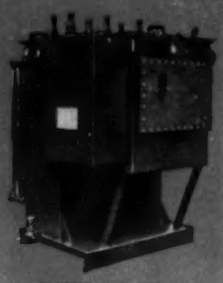
SAVINGS IN MATERIAL AND TIME

Improvement in regulation was needed because of the small conductors installed in this area. If regulators had not been used, it would have been necessary to extend the 11-kv feeder all the way to the airfield—by changing over a considerable portion of 2300-volt line to 11 kv. This alternative would have required a much greater expenditure of the critical materials so sorely needed for other war needs. Also, the ready availability of G-E feeder regulators and their ease of installation made the use of regulators the quickest method of doing the job.

If you need additional capacity, ask your G-E representative to estimate the savings in time and critical materials that can be obtained on your feeders with G-E feeder regulators, or write for Bulletin GEA-2762. *General Electric Company, Schenectady, N.Y.*

BUY WAR BONDS

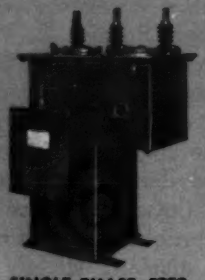
One of a series telling of wartime distribution problems being solved with G-E feeder regulators—applications where they saved critical materials or otherwise helped the war effort, like some jobs you may have.



THREE-PHASE STEP

SINGLE-PHASE INDUCTION

SINGLE-PHASE INDUCTION



SINGLE-PHASE STEP

DRY-TYPE INDUCTION

GENERAL ELECTRIC

404-32-5400

FEEDER REGULATORS

HOW DESIGN... CONSTRUCT OPERATE MAINTAIN

Chain-Inclosed Ball Cleans Penstock

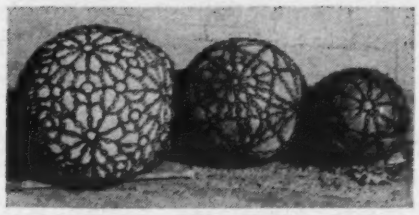
By F. H. WILEY
Superintendent Electric Division,
Department of Public Utilities
Colorado Springs, Colo.

Loss of head on hydro plants is a matter of concern at any time, and particularly now, when every kilowatt-hour is needed for war production. Faced with an increase in friction head and a loss in plant capacity, the electrical department of the city of Colorado Springs, Colo., undertook a penstock cleaning job that proved inexpensive and that fully restored plant capacity to its original rating.

The method employed used a patented device known as a "Rotary Pipe Crawler," consisting of an inflated rubber ball with inclosing chain with diameter slightly greater than that of the pipe to be cleaned. The ball or "Go-devil," as it is called, is inserted into the pipe and carried through by water flow, cleaning and scouring as it moves along.

In the case of the Colorado plant a 2½-mile stretch of 20-in. outside diameter line with a total head of 1,165 ft. was installed in 1925, developing 1,250 kw. at the plant. By 1943 the friction head had increased from 15.2 ft. per thousand to 34.5 ft. per thousand feet of pipe based on a flow of 21 c.f.s. with a consequent drop in power from 1,250 to 990 kw., or a loss in generating capacity of 6,240 kw.-hr. each 24 hours.

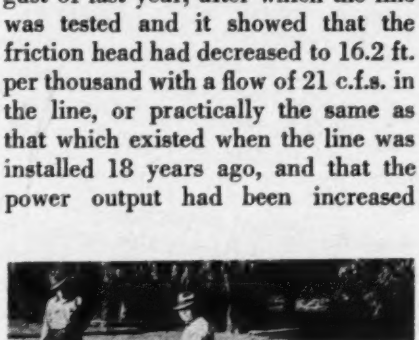
On inspection in July, 1943, the tubercules in the line were found to be about a quarter of an inch. Patentee of the device advised a pilot run with an 18-in. crawler filled with air as an exploratory test to determine any



HYDRO PLANT CAPACITY was restored by removing tubercules from penstock with cleaner of this type. Shown are 18-in., 24-in. and 30-in. crawlers

major obstacles which might exist in the line, such as a 2x4 left in during construction or large rocks, and to follow this up with a crawler slightly larger than the original inside diameter of the line, namely about 19½ in., to complete the cleaning.

This work was carried out in August of last year, after which the line was tested and it showed that the friction head had decreased to 16.2 ft. per thousand with a flow of 21 c.f.s. in the line, or practically the same as that which existed when the line was installed 18 years ago, and that the power output had been increased



ROOTS taken out of a water main with pipe cleaner at Corona, Calif.

from 990 kw. to 1,250 kw. Total time required was four men for seven days, but it is estimated that in the future four men can do the job in from two to three days. Figuring power at 1 cent per kw.-hr., the cost of cleaning paid for itself within a few days.

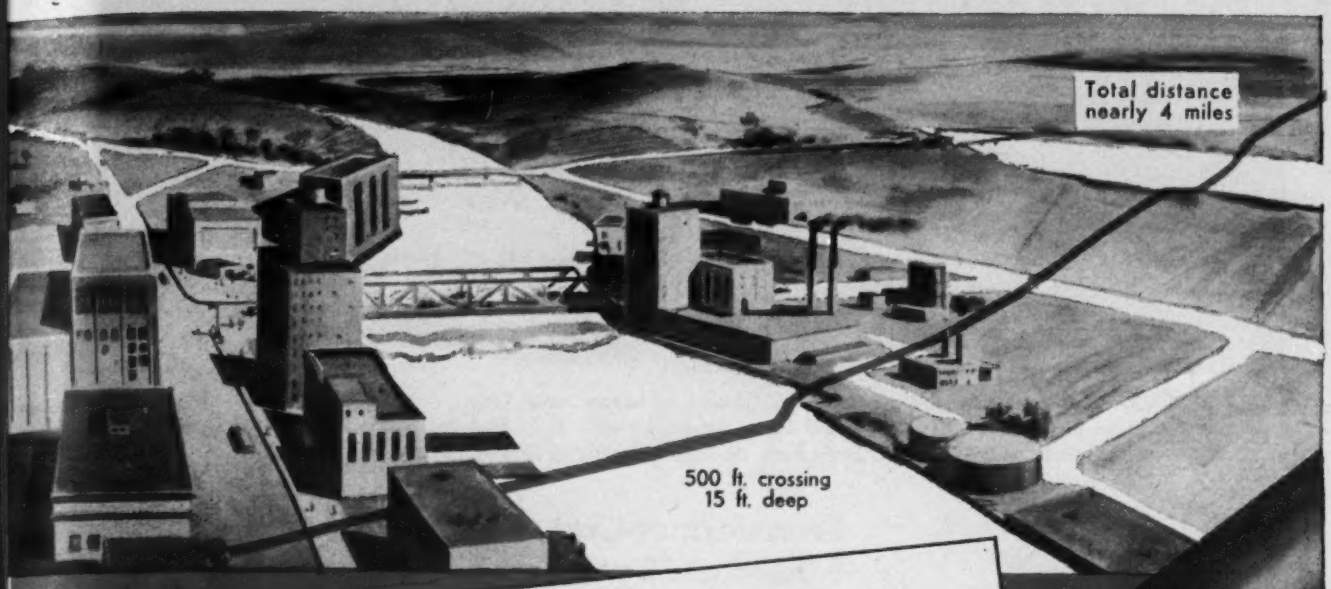
It took about 2 sec.ft. of water to move the crawler in flat parts of the line where it moved only one or two miles per hour. Down the steep slopes movement was clocked accurately and showed 1,056 ft. in 30 seconds, or a speed of about 24 m.p.h. The time through the whole 12,800 ft. of line varied from 30 to 46 minutes on the several trips of the crawler. As was to be expected, the chain was completely worn out after the eight trips made.

•

Automatic Reel Brake for Cable Pulling

A new automatic reel brake used in pulling cables and designed by John White of the Detroit Edison Company, underground lines department, is expected to effect appreciable savings for the company in reel job costs. White's new reel brake automatically prevents the cable reel from unwinding during pauses in the operation of pulling cable from a duct.

Heretofore, the generally accepted technique has been to put a wedge under the reel chime to hold it stationary each time pulling is halted to obtain a new position for the cable-pulling grip. This method necessitates frequent manual changes in wedge position under the reel chime to prevent the reel from turning backward and allowing the cable to sag back into the manhole. Also, weight



The First SUBMARINE INSTALLATION

Low-pressure Gas-filled Cable Goes on 34.5-kv Duty

ONE Midwest utility, already serving a capacity load on its 34.5-kv network, had to increase that capacity in order to supply a new war plant. The best method was to put in a two-circuit, direct tie between two points in the system nearly four miles apart.

The only route available for this tie lay through a congested duct system in a downtown area, and included two 500-foot river crossings, with a water depth of 15 feet.

Various types of cable were considered. Some were unsuited because of small manholes, congested conditions in the downtown area, or the possibility of electrolysis. The requirements indicated a need for the simplest type of cable affording the utmost reliability at low cost.

Therefore, gas-filled cable, with its favorable thermal and dielectric characteristics, was selected. Also, sheath damage to this type of cable can be detected without circuit failure. The installation is now in successful operation.

For information about G-E gas-filled cable, ask the nearest G-E office for Bulletin GEA-3652, or write *General Electric Company, Schenectady, New York.*

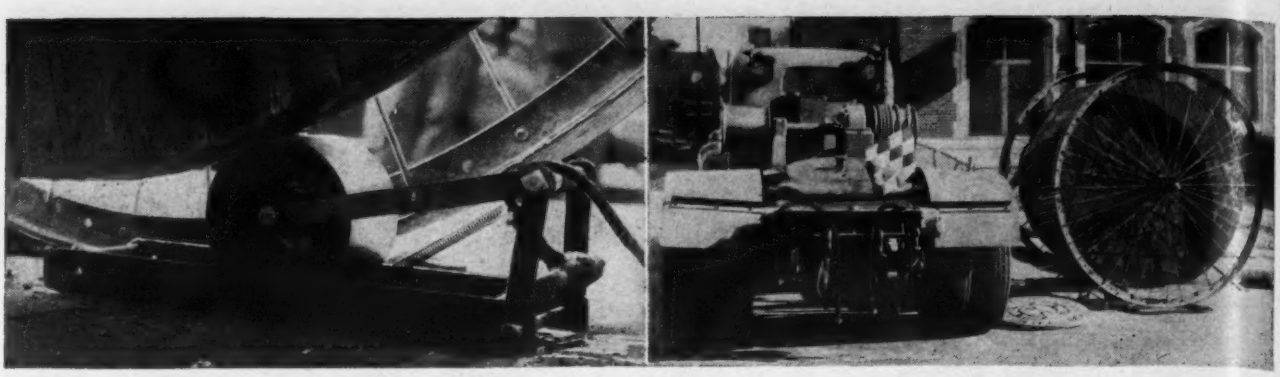
GAS-FILLED CABLE *Offers*

1. SELF SUPERVISION—prompt automatic warning if a leak occurs
2. ECONOMY—easy to install, no auxiliary manhole equipment
3. SMALL SPACE REQUIREMENTS—more power for a given duct size
4. UNIFORMITY OF INSULATION—no need to worry about compound migration

Invest in your future. BUY WAR BONDS

GENERAL ELECTRIC

501-19-1200



CABLE REEL BRAKE in operating position under reel chime; as shown, reel turns counter-clockwise during pulling operations; rope attached to handle of brake has no bearing on its operation (left). Truck and cable reel complete with brakes and ready to pull cable from a manhole under the truck; brakes are used under both reel chimes (right)

of the reel and cable on the wedge frequently causes it to "chew up" and damage the reel chime.

White's reel brake is automatic in action, making it unnecessary for a crew member to use a wedge. The brake consists of a 6-in. channel iron in which runs an 8-in. diameter metal roll with a face width corresponding to the web of the channel. A spring-loaded linkage, for controlling movement of the roll, completes the assembly. The spring is about $\frac{1}{2}$ in. diameter, 3 in. long and develops a tension of 10-15 lb.

In use, the brake is placed under the reel chime as shown in the illustration. As the chime turns and cable is gradually pulled from the duct, the brake roller is forced up the channel (to the right in the picture) in the direction of rotation of the reel chime against the tension of a coil spring. When the reel is stopped tension of this spring forces the roll tightly under the chime. Any tendency of the reel to turn backward (clockwise in the picture) acts to wedge the roll even more tightly against the chime, preventing further backward motion.

The reel brake is compact and portable. It does not require attachment to the support holding the cable reel. However, it is desirable to use two brakes on each reel; one under each chime. Attempts to use one brake resulted in a tendency to cant the reel.

Material used in the surface of the brake roller has been the subject of some experimentation. Automobile brake lining and a smooth metal surface have been tried; both result in slight slippage between roller and chime. It is planned to try welding small beads of metal on the surface of the future rollers in an attempt to correct this minor difficulty.

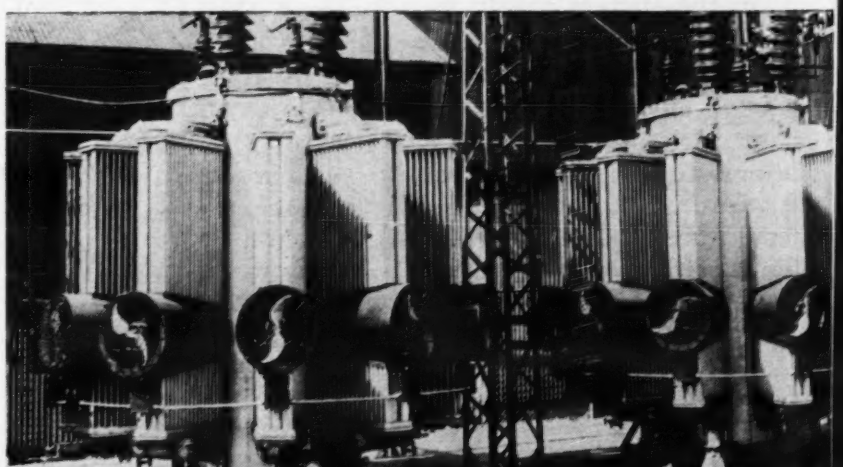
Transformer Capacity Added at $2 per Kva.

By W. L. WINTER
Westinghouse Electric & Manufacturing Company, San Francisco, Calif.

A recently completed installation of blowers on a bank of transformers by a large utility on the West Coast resulted in obtaining an increase from 3,000 kva. to 3,750 kva. per unit at a cost slightly under $2 per kva. of increased capacity. The transformers, which were released from another load, were rated 2,500 kva. at 35 deg. C. rise, 3,750 kva. at 55 deg. C. rise, oil-insulated, water-cooled, primary 31,215/54,000 Y volts, secondary 6,900/12,000 Y volts and tertiary 2,300 delta volts at reduced capacity. The secondary winding was built with three 2,300-volt sections with leads brought to a terminal board for 2,300 or 6,900-volt connection.

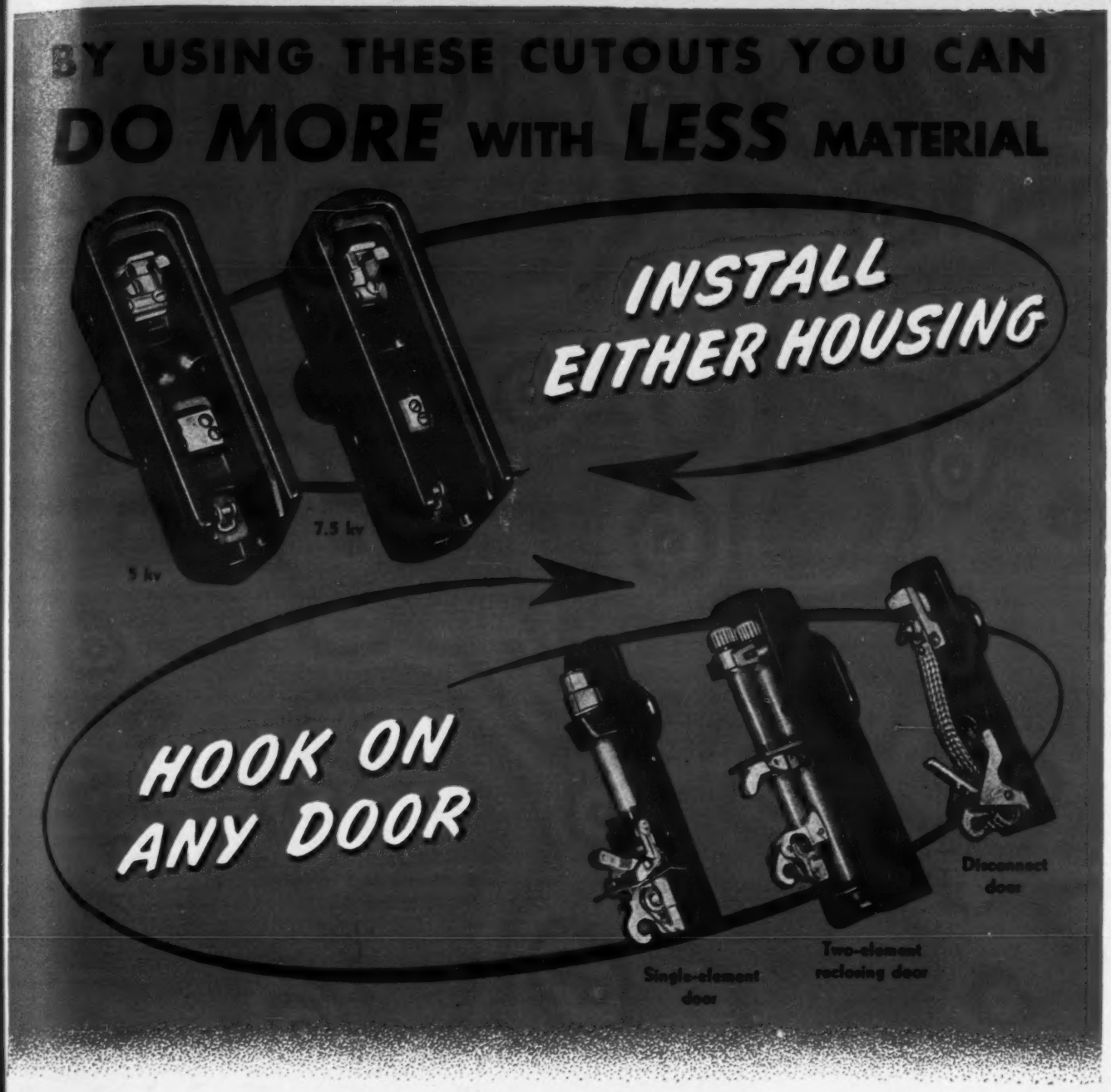
In 1928 a steel mill on the company's lines made additions requiring about 9,000 kva. more capacity at 2,300 volts. Since no cooling water was readily available, the transformers were converted to self-cooled units by installing twelve 7-ft., 47-tube radiators on each tank. The radiating surface thus provided was theoretically adequate to care for the losses at the full rating of 3,750 kva. at 55 deg. C. rise. Tests indicated that a conservative rating as self-cooled units was about 3,000 kva. and they were operated on that basis.

The transformers proved adequate until 1942, when major additions by the steel mill called for an increase in demand to a total of about 18,500 kva. Addition of small individual blowers to each radiator supplied the requisite additional cooling for an increased rating to 3,750 kva. Installation of a second bank of 2,500-kva. transformers then provided a total capacity of 18,750 kva., ample for the new load and a slight margin to spare;



TRANSFORMERS were originally rated OIWC 3,000 kva. when purchased in 191[illegible] increased load and unavailability of water at new location called for radiators and blowers to increase rating to 3,750 kva.

BY USING THESE CUTOUTS YOU CAN DO MORE WITH LESS MATERIAL



WHEN you use G-E fuse cutouts, smaller stocks adequately take care of your requirements. Why? Because each G-E cutout can do any one of three different jobs. You can convert a G-E cutout from a single-element unit to a reclosing unit, or to a disconnect, simply by changing the door.

The single-element door has a selecting device to permit either indication of a blown fuse or "drop-open" action. The reclosing door contains the entire mechanism, complete with one-second time delay before reclosing. The disconnect door has an indicating feature for easy spotting, and a can't-be-lost blade which is isolated to protect the lineman.

Just five major parts, in the 50-ampere rating, will fill 80 per cent of all distribution-cutout requirements. And there's a similar two-housing, three-door combination in the 100-ampere rating to take care of the other 20 per cent.

Ask for Bulletin GEA-3448. *General Electric, Schenectady, N. Y.*

FUSE CUTOUTS

GENERAL ELECTRIC

406-14-5224

Now YOU CAN ORDE

5905 Page 6
May 3, 1943

UNIT SUBSTATIONS

REPETITIVE-MANUFACTURE

MASTER UNIT SUBSTATIONS

13.2 Kv-66 Kv Primary Voltages
4.33 Kv or 2.5 Kv Secondary Voltages

BASIC SPECIFICATIONS FOR UNIT ARRANGED AS IN FIG. 10

Unit Substation Rating

The outdoor unit substation will have the following rating in accordance with the Standards of the American Institute of Electrical Engineers:

Capacity.....("x") Kva
Frequency.....60 cycles
Phases.....Three
One incoming three wire 13.2-66 Kv circuit
Two outgoing three wire 2300 volt or four wire 4330 volt circuits.

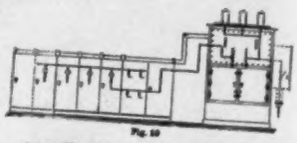


Fig. 10

The Outdoor Unit Substation Will Consist of the Following Co-ordinated Parts:

Transformer Section with

Three-phase transformer oil-filled rated ("x") kva self-cooled (55 C rise), 60 cycles with ( ) kv high voltage and 2300-volt delta or 4330-volt grounded wye low voltage.

The transformer section shall be provided with:

Cover bushings — Three-element winding temperature equipment

Standard accessories

Sealed tank construction 1500 kva and below at voltages 34.5 kva and below. Gas-oil seal all other ratings. — Two 5% rated kva taps below normal rated high voltage with externally operated manual tap changer

All details will be in accordance with the applicable sections of the Proposed Standards of the ASA, dated March 1940.

If specified, automatic tap-changing equipment will be furnished which will operate under load to give 8 approximately 15/16% taps above rated secondary voltage; and 8 approximately 15/16% taps below rated secondary volts at a current equal to the transformer current at rated kva and rated secondary volts. This equipment will include a contact-making voltmeter, line-drop compensator, necessary auxiliary control mounted in a weatherproof steel compartment.

The transformer section low-voltage bushings and metal throat will be properly co-ordinated to bolt together with the feeder switchgear section in the field.

Feeder Switchgear Section with One Auxiliary Compartment containing:

1—Hinged steel panel.
1—Relay, auxiliary, with automatic-reset contacts, and hand-reset target, connected to the transformer-temperature relay for tripping the transformer-secondary circuit breaker in case of excessive transformer winding temperature.
1—Watthour meter with indicating demand register.
1—Voltmeter and transfer switch.
3—Potential transformers, 2400/120-volt, 200 kva with fuses of the current-limiting type.
1—Control-power transformer for closing circuit breakers, oil-cooled, single-phase, 5 kva, 2.5 kv, 230/110 v
1—Storage battery for breaker tripping 24-v sealed-in-glass jar type, consisting of two six-cell units having a suitable discharge rate to a final voltage of 1.87-v per cell.
1—Copper oxide battery charger with ammeter, cut-off switch, and variable resistor.

One Transformer Secondary Breaker Compartment with
1—Power circuit breaker, vertical lift type, TPST, ("q") amp, ("p") kva interrupting capacity, 220-v, 4-v trip coil, necessary auxiliary switches, latch-checking switch and control relay.
1—Hinged steel panel.
3—Relays, overcurrent induction type with inverse-time characteristics for back-up short-circuit protection. Operation of these relays will trip all power circuit breakers in the unit substation.
1—Circuit breaker control switch, with red and green indicating lamps and maintaining contacts.
1—Relay, reverse power, for tripping the transformer breaker on reverse power faults.
3—Relays, overcurrent, induction to provide the above reverse power relay with overcurrent time-delay characteristics.
1—Reclosing relay, for reclosing the transformer secondary breaker upon the restoration of normal three-phase voltage of proper phase rotation at the power transformer secondary.
1—Control-power transformer for closing circuit breakers, oil-cooled, single-phase, 10 kva, 2.5 kv, 230/110 v with fuse of the current-limiting type.
1—Control-power switch.
3—Current transformers.
3—Potential transformers, 2400/120 volts, 200-volt-amperes, with fuses.

Two Feeder Breaker Compartments each with
1—Power circuit breaker, vertical lift type, TPST, ("x") amp, ("x") kva interrupting capacity, 220-v, 4-v trip coil, necessary auxiliary switches, latch-checking switch, and control relay.
3—Current transformers.

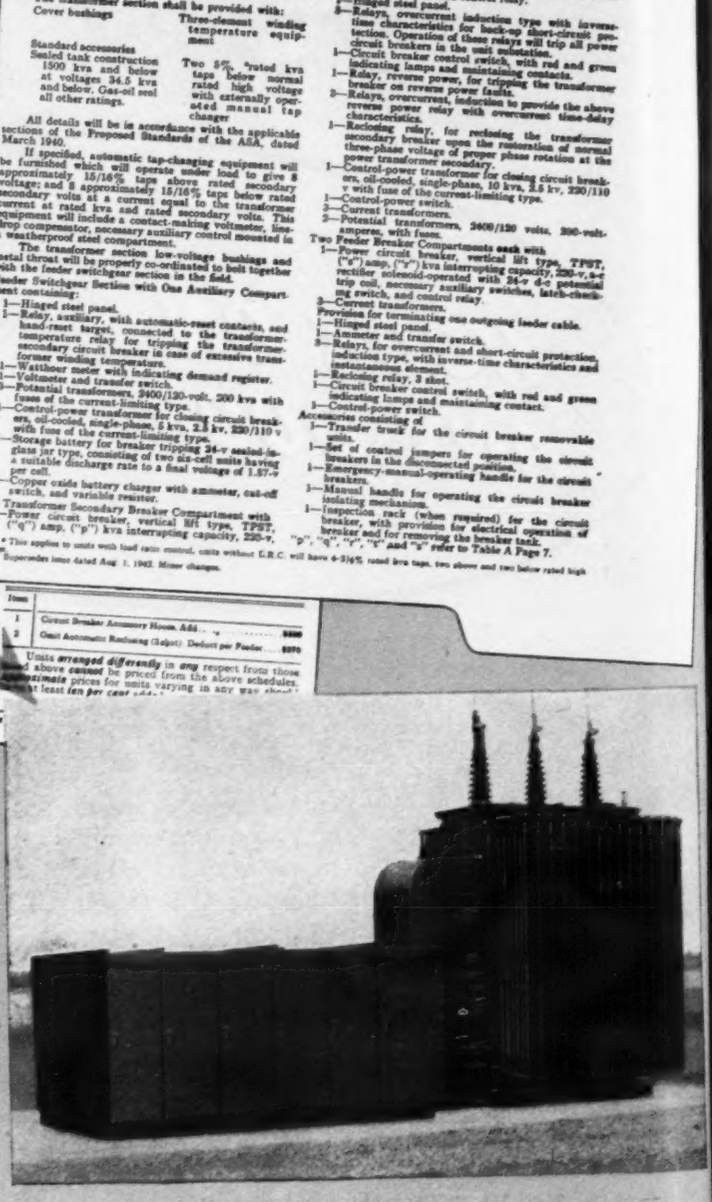
Provision for terminating one outgoing feeder cable.
1—Hinged steel panel.
1—Ammeter and transfer switch.
3—Relays, for overcurrent and short-circuit protection, induction type, with inverse-time characteristics and instantaneous element.
1—Reclosing relay, 3 shot.
1—Circuit breaker control switch, with red and green indicating lamps and maintaining contact.
1—Control-power switch.

Accessories consisting of
1—Transfer truck for the circuit breaker removable units.
1—Set of coastol jumpers for operating the circuit breakers in the disconnected position.
1—Emergency-manual-operating handle for the circuit breakers.
1—Manual handle for operating the circuit breaker isolating mechanism.
1—Inspection rack (when required) for the circuit breaker, with provision for electrical operation of breaker and for removing the breaker truck.

"p", "q", "r", "s" and "t" refer to Table A Page 7.

Units *arranged differently* in *any* respect from those above *cannot* be priced from the above schedules. *Approximate* prices for units varying in any way should at least *ten per cent* additional.

Supersedes issue dated Aug. 1, 1942. Minor changes.



THIS 5000-kva unit substation with five feeders was ordered by a large war plant simply as "One Cat. No. US7J5 unit substation." The weeks of time and hundreds of dollars saved by the "one catalog number" method of ordering, to get a substation installed and operating sooner, is one of the many examples of planned efficiency in the war effort.

A COMPLETE SUBSTATION BY ONE CATALOG NUMBER

—a result of standardization and repetitive manufacture*

What G-E *unit substations* offer you:

LOWER CAPITAL INVESTMENT. Unit substations have opened a profitable new field for electric-service company distribution engineers who right now are studying their systems with a view to avoiding unnecessarily large capital expenditures. The valuable time normally spent in worrying about substation-design details can now be much more profitably devoted to *system* engineering and planning.

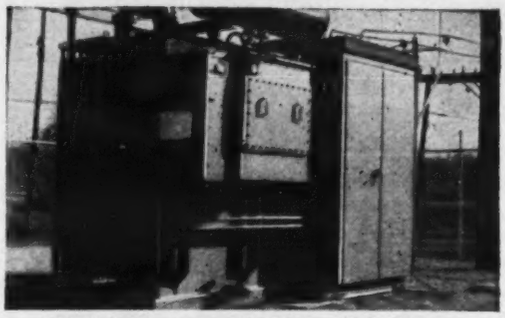
BETTER SYSTEM OPERATION. A well-planned system, one which has completely automatic, standard *unit substations,* means fewer customer outages, better voltage conditions, and a lower equipment-failure rate. The dispersal provided by a number of smaller units, compared with one large, central substation, localizes troubles and prevents huge equipment losses as well as large-area outages resulting from fires, explosions, or other misfortune.

GREATER FLEXIBILITY. *Shifting* loads are easy to follow because these standardized units are relatively easy to move. *Increasing* loads are easy to handle by purchasing additional units as they are needed. This precludes the possibility of installing a large substation and waiting for a load which may never develop.

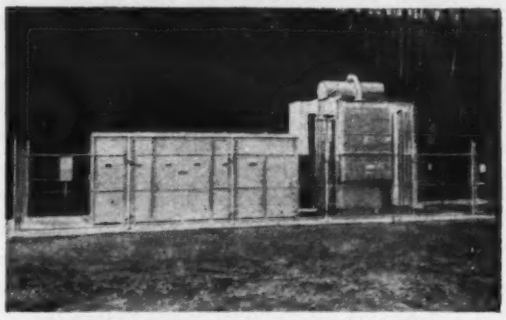
LOWER OVERHEAD. G-E *unit substations* are shipped directly to the installation site in completely assembled sections. You save the time and expense of passing hundreds of parts through stockroom or warehouse. You avoid the confusion of lost, delayed, or forgotten parts and duplicate pieces, rush orders, and consequent rehandling. Installation is always much easier and faster than it is with a piecemeal substation, and there can be a more efficient use of man power. Crews quickly become familiar with them because there are only two or three pieces to handle.

CENTRALIZED RESPONSIBILITY. The combined and co-ordinated efforts of General Electric's substation, transformer, switchgear, relay, meter, and application engineers assure the fulfillment of your specifications. The constant efforts of this highly trained group mean continued improvements in available standard unit substations—with lower and lower costs.

** G-E unit substations are now being built repetitively from standard components for almost any application you may have. Ask your G-E representative for Bulletin GEA-3800, or for a detailed presentation of our complete line in the light of your specific problem. General Electric Company, Schenectady, N. Y.*



1000-kva unit substation—Cat. No. US2A1



1500-kva unit substation—Cat. No. US3A2

3000-kva unit substation—Cat. No. US5NE4

UNIT SUBSTATIONS

Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds.

GENERAL ELECTRIC

the pounds of critical materials, copper and steel, required to add the blowers was considerably less than would be required if the second bank were made large enough to carry the difference between 9,000 kva. and 18,500 kva.

Total cost of adding the blowers to obtain the additional capacity of 750 kva. per unit was approximately $1,450 each, or slightly under $2 per kva. of increased capacity. This figure compares favorably with a cost of over $3 per kva. if the same capacity had been secured by purchasing larger transformers for the second bank.

The urgent need to conserve critical materials and the considerable monetary saving influenced the company in favor of the blower installation. The accompanying illustration shows the transformers with fans added to the radiators for forced-draft self-cooling.

Each transformer is equipped with twelve blowers and with a control cabinet containing a contactor and a temperature relay to start the fans when the top oil temperature exceeds a safe value. Each fan motor is protected with thermal type fuses. Field installation of the blowers offered no complications.

Ideas and Kinks from a Utility Shop—II

Here are more examples of ingenuity seen in the repair shops of the Birmingham (Alabama) Electric Company. The first batch was printed in ELECTRICAL WORLD, January 22, page 140.

A large vat containing cleaning solution has a heavy hinged cover which is counterweighted. As the cover rises and more of its weight bears on the hinges the counterweight tries to jerk it upright. This is overcome by a supplementary counterweight which acts against the first when slack in its cable is taken up as the lid rises to the half-way position.

Disposal of unreclaimable insulating oil is often a problem. Some of the old oil is used to heat this shop. The grates of a coal stove of the cross-roads grocery store type were replaced by a circular plate of cast iron on which is laid a flat spiral of asbestos wicking. In the center of the plate is a hole through which the oil, fed from a gravity tank and controlled by a valve, wells up and soaks the wicking. Centered over the plate and an inch or so above it is the bottom end of a draft tube which extends downward from a hole cut in the top lid of the stove. The fire could be put out by closing the oil valve and letting the wicking burn dry. But that would spoil the wicking within a short time. Therefore an extinguisher is provided. This is a plate of iron which is inserted through the stove door and laid on the burner plate, smothering the flame.

Part of the work in this shop is the assembly of leads and bushings for distribution transformers. To cut the leads to length, a bolt cutter head is used. The head is mounted solidly on the bench and is operated by a pedal through a lever motion, the parts of which once saw duty as transformer hangers.

In the meter shop the usual can of enamel thinner is fitted with a spout and hung in a wooden frame so that it can be tilted to pour. Spilling is thus avoided.

Also in the meter shop is a meter holder, very handy for repair work and special tests. It consists of a square frame with a cross piece which is movable up and down and may be tightened with screws at the ends. The frame is mounted in an old floor lamp base and may be rotated. Holes placed in the cross piece allow any type or size of meter to be hung on the frame.

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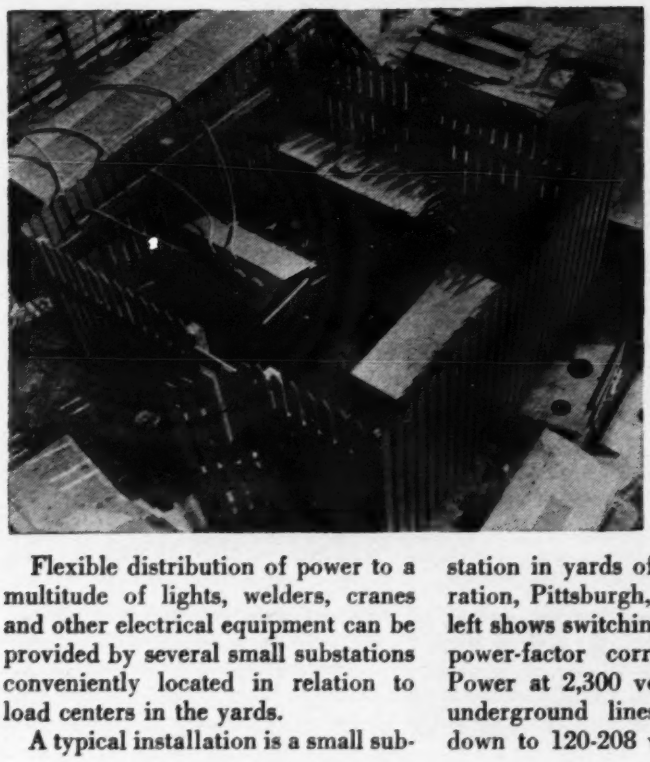
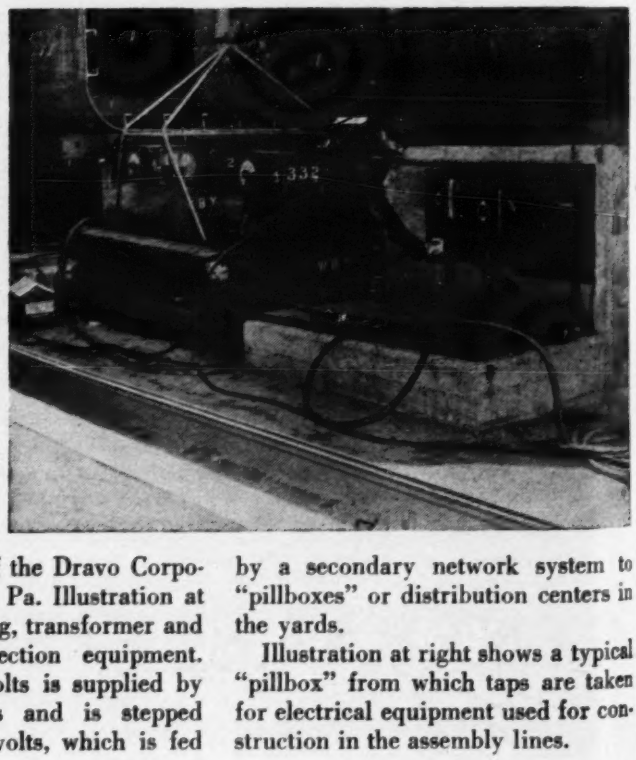
Small "Subs" Supply Yard Centers





Flexible distribution of power to a multitude of lights, welders, cranes and other electrical equipment can be provided by several small substations conveniently located in relation to load centers in the yards.

A typical installation is a small substation in yards of the Dravo Corporation, Pittsburgh, Pa. Illustration at left shows switching, transformer and power-factor correction equipment. Power at 2,300 volts is supplied by underground lines and is stepped down to 120-208 volts, which is fed by a secondary network system to "pillboxes" or distribution centers in the yards.

Illustration at right shows a typical "pillbox" from which taps are taken for electrical equipment used for construction in the assembly lines.

How to Determine

SIZE OF SECONDARY CONDUCTOR TO PREVENT LAMP FLICKER[1]

By S. LUBIN[2] and F. B. SCOTT[3], REA Technical Standards Division

Increased use of motors and other industrial loads on rural lines has, on some systems, introduced flicker problems. A solution to the problem of flicker presented in this and two subsequent reference data sheets employs a set of nomograms to determine the proper size of secondary or service conductor to be used when the load and service transformer specifications as well as length of secondary or service circuits are known.

The following considerations should be taken into account in using the charts:

1. The values obtained from the charts are valid provided the primary regulation is sufficient to take care of the starting current. In cases where primary regulation is poor other corrective measures may have to be applied.

2. Since in some cases the method outlined here would require the use of service conductors or transformers of larger sizes than is usual some judgment should be used in its application. It should be applied only where motor loads are coincident with lighting demands.

3. When a current-limiting starting device is used the value of starting current used in the calculations should be the value as limited by the starting device. Average starting currents and starting power factors of various types of motors are given in the accompanying tables, in lieu of more precise data.

Table I—Average Starting Currents of Three-Phase Squirrel-Cage Induction Motors

Hp.	Volts (Line-to-Line)					
	110	208	220	440	550	2,200
1/8	....	..	3.7	.....	.....	....
1/6	....	..	4.6	.....	.....	....
1/4	....	..	6.4	.....	.....	....
1/3	....	..	9.6	.....	.....	....
1/2	19	..	10	4.8	3.8	....
3/4	29	..	15	7.1	5.7	....
1	41	..	21	10	7.9	....
1½	58	..	31	15	13	....
2	72	..	38	18	15	....
3	105	57	52	25	20	....
5	165	88	82	41	36	....
7½	235	115	120	57	46	....
10	300	155	150	74	59	....
15	415	225	220	105	84	....
20	490	285	275	130	105	....
25	660	360	355	165	135	....
30	775	410	415	190	155	40
40	1,110	530	555	275	220	55
50	1,370	715	690	345	290	68
60	1,650	..	865	410	340	95
75	2,010	..	1,050	500	395	110
100	2,940	..	1,500	735	590	150
125	3,380	..	1,800	845	675	195
150	4,610	..	2,390	1,155	920	255
200	6,580	..	3,290	1,635	1,320	295
250	7,300	..	3,650	1,825	1,460	365
300	....	..	.....	.....	.....	475

USE OF THE CHARTS

Following information is required before the secondary conductor size can be determined from the charts:

1. Number of starts per hour, minute or second of the motor.
2. Make and size of distribution transformer to be used.
3. The supply voltage (E) on the secondary or service.
4. The starting current (I) of the motor.
5. Power factor of the motor at starting ($\cos \theta$).
6. Length of secondary or service circuit (L).

The general procedure is then as follows:

1. Determine the allowable percent of voltage fluctuation from Chart I.
2. Determine the percent R and percent X of the transformer from Table IV.
3. Convert the allowable percent voltage fluctuation to allowable percent of transformer and secondary impedance drop by use of Chart II.
4. Determine the percent voltage drop in the transformer and the percent resistance drop in the secondary or service conductor from Chart III.
5. Obtain the required conductor size or resistance in ohms per 1,000 ft. from Chart IV.

Detailed steps and examples will be given in subsequent issues.

[1]First of a series of three reference sheets.
[2]Engineer, on leave of absence.
[3]Senior engineer.

Table II—Average Starting Currents of Single-Phase Motors

Hp.	Condenser-Start		Split-Phase	Repulsion-Induction	
	Volts				
	110	220	110	110	220
1/8	..	..	17	13	..
1/6	22	..	28	13	..
1/4	23	..	29	14	..
1/3	23	12	30	19	..
1/2	..	16	37	26	14
3/4	..	23	60	38	20
1	..	30	..	..	25
1½	..	..	..	..	34
2	..	..	..	..	41
3	..	..	..	..	58
5	..	..	..	..	95
7½	..	..	..	..	150

Table III—Average Starting Power Factor of Motors

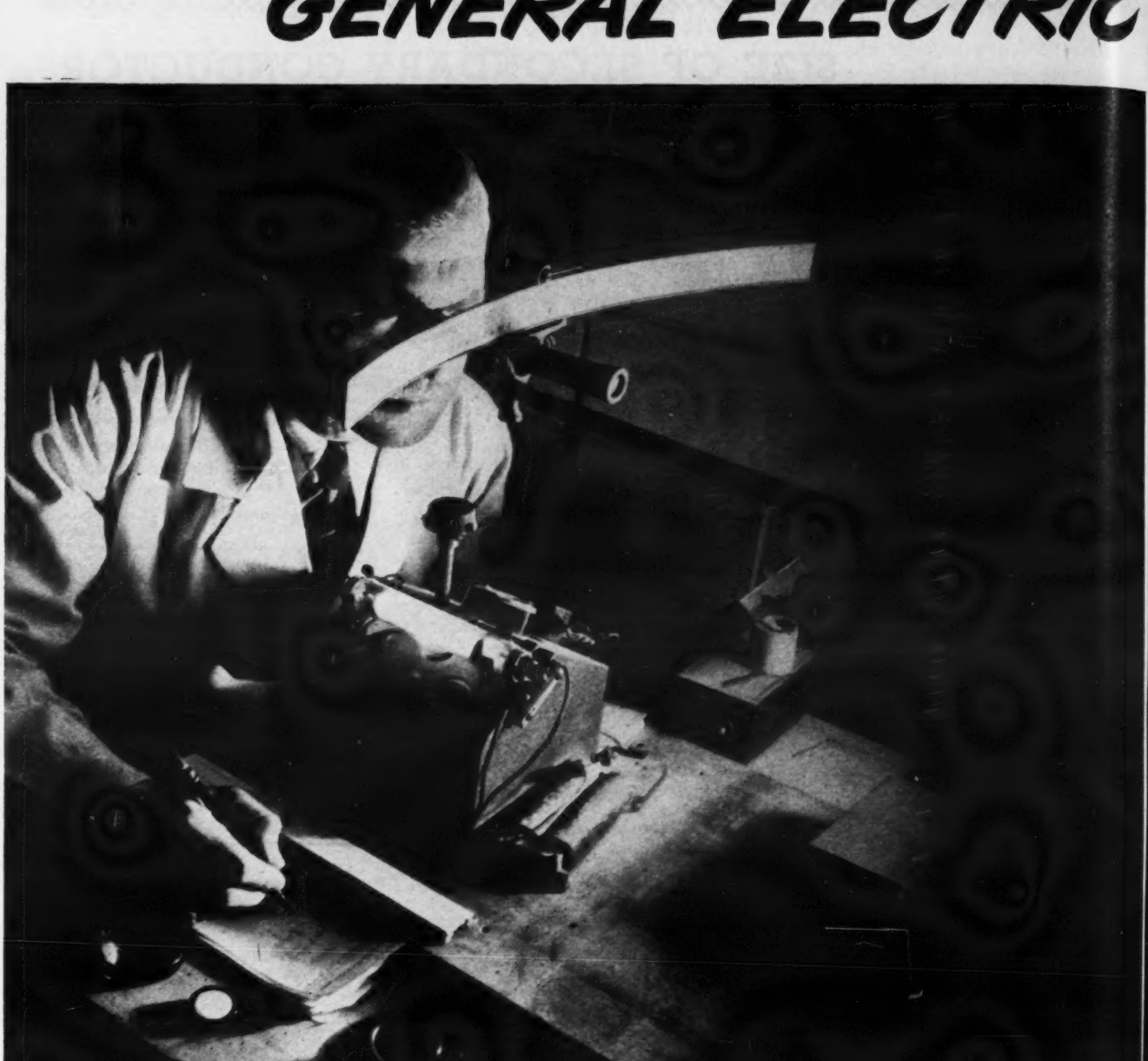
Type of Motor	Power Factor ($\cos \theta$)
Single-Phase	
Capacitor-start	0.85
Split-phase	0.75
Repulsion-Ind	0.65
Three-Phase	
Squirrel-cage	
Under 3 hp	0.40
Over 3 hp.	
Normal-torque	0.35
High-torque	0.60
High-slip	0.65

Table IV—Percent Resistance and Percent Reactance of Distribution Transformers*

Transformer Rating, Kva	Allis-Chalmers		General Electric		Kuhlman		Line Material		Moloney		Standard		Wagner		Westinghouse	
	% R_T	% X_T	% R_T	% X_T	% R_T	% X_T	% R_T	% X_T	% R_T	% X_T	% R_T	% X_T	% R_T	% X_T	% R_T	% X_T
1.5	2.37	2.08	2.67	2.11	2.60	1.46	2.80	1.33	2.73	1.67	2.60	1.31	2.25	1.31	2.78	1.15
3	2.08	2.04	2.33	2.50	2.16	1.56	2.53	1.61	2.40	1.80	2.27	1.80	2.26	1.80	2.47	1.52
5	2.25	1.79	2.30	2.08	2.16	1.44	2.30	1.93	2.42	2.10	2.20	1.90	2.20	1.99	2.22	1.30
7.5	2.00	2.21	2.15	1.64	2.27	1.60	2.08	2.02	2.27	2.34	2.15	1.80	1.81	1.69	2.06	1.15
10	1.85	2.25	2.00	1.96	1.90	1.84	2.00	2.10	2.02	2.26	2.00	1.90	1.83	2.11	1.79	1.75
15	1.53	2.24	1.72	2.21	1.78	2.52	1.65	2.39	1.82	2.87	1.72	2.20	1.65	2.29	1.58	1.80
25	1.42	2.57	1.51	2.36	1.47	2.40	1.47	2.50	1.53	3.14	1.51	2.40	1.36	2.88	1.60	2.28
37.5	1.32	2.79	1.31	2.47	1.33	3.58	1.27	2.61	1.35	2.90	1.31	2.50	1.20	2.88	1.38	2.68
50	1.16	2.91	1.22	2.52	1.04	3.60	1.23	2.62	1.38	2.96	1.22	2.50	1.08	3.30	1.34	2.44
75	1.09	2.64	1.10	4.47	1.25	3.36	1.15	4.46	1.31	3.10	1.10	3.10	1.16	3.44	1.20	3.40
100	1.13	3.07	1.12	4.46	1.23	3.46	1.13	4.46	1.24	3.10	1.10	3.20	1.07	4.41	1.20	3.70

*Rating from 1.5 kva. to 15 kva. inclusive are REA type. Rating of 25 kva. and above are conventional double bushing type. Values of R_T and X_T are from manufacturers' data as of January, 1942.

GENERAL ELECTRIC



TO move the sun indoors . . . to bring into our homes, stores, schools, offices, and factories the kind of lighting that compares favorably with daylight . . . that has been the constant vision of General Electric lamp research scientists.

Today the goal is closer than ever before . . . perhaps closer than many of us realize. And yet, we have only just begun to explore the possibilities of new lighting techniques.

BUY AN EXTRA WAR BOND NOW!

Some of these lighting tools will be available as soon as the requirements of war production have been met; some must await the development of manufacturing facilities; others require further study in research laboratories.

The introduction of fluorescent lighting by General Electric opened the door to a new world of better lighting. Continued G-E research will open the door much wider.

Hear the General Electric radio programs: "The G-E All-Girl Orchestra" Sunday 10 p. m. EWT, NBC; "The World Today" news, every weekday 6:45 p. m. EWT, CBS

GENERAL ELECTRIC

FLUORESCENT RESEARCH LOOKS AHEAD

THESE NEW ADDITIONS ALREADY ARE PLANNED FOR G-E's POST-WAR FLUORESCENT LAMP LINE

TO make a complete line of lamps and the best lamp for every lighting need always has been the aim of General Electric lamp research.

Numerous requests indicate that the lighting industry wants to know about new lamp developments as far in advance as possible. Looking toward the future, G-E sees the need for several new fluorescent lamps.

As soon as conditions permit, we expect to extend our line of G-E Mazda fluorescent lamps by offering the following new lamps:

STRAIGHT TUBULAR G-E MAZDA F LAMPS

LENGTH (INCLUDING SOCKETS)	APPROXIMATE BULB DIAMETER
Approximately 5½ ft.	T-4 or T-5
" 5½ ft.	T-6
" 5½ ft.	T-8
" 7½ —8 ft.	T-6

CIRCULAR G-E MAZDA F LAMPS

(Announced December 27, 1943)

APPROXIMATE OUTSIDE DIAMETER	MAXIMUM BULB DIAMETER	APPROXIMATE WATTS
8½"	T-10	20
12¼"	T-10	30
16 "	T-10 or T-12	40

G-E Lamp Research has been, and still is, at war. Because of wartime restrictions, no production facilities for these lamps are at present available, and therefore *no samples can be furnished.* However, as soon as it is possible to estimate when such lamps can be manufactured, we will give you further details and additional information as to transformers, ballasts, sockets, and other accessories.

* * *

No part of your business offers a better opportunity for *immediate* post-war profits than G-E Mazda lamps. The demand for better lighting will be tremendous. General Electric will be ready to supply the lamps and help you sell them.

"TO MAKE LAMPS STAY BRIGHTER LONGER"
The Creed of G-E RESEARCH

G-E MAZDA LAMPS

How to Test Insulating Materials*

5. Arc Resistance Test

By J. R. FREED
Continental-Diamond Fibre Company, Newark, Del.

Solid electrical insulating materials are given an arc resistance test to classify them. The standard method of test is A.S.T.M. D-495. Equipment includes a transformer having a rating not less than 12 kv. and 1.2 kva., a milliammeter, a motor-driven interrupter, and two tungsten-tip electrodes mounted in a wood block. The energy supply is 60 cycles per second.

A flat portion of the sample is placed beneath the points of the two electrodes, adjusted to a gap of 0.320 in., and a high-voltage, low-current a.c. arc is increased at one-minute intervals until the material fails by becoming conducting. The sequence of current steps is listed in the table. The progressive increase is carried either to failure of the material or until the current has reached 100 m.a., but is discontinued beyond this latter point to avoid burning the electrodes. However, practically all materials will have failed long before that point is reached.

First three steps of the test, as listed in the table, make use of an interrupted current cycle since a less severe condition than a continuous 10 m.a. arc is desired, but a lower current arc would neither be steady nor impeccably continuous.

Surface of the sample should be clean and dry, otherwise the results will be seriously altered. Also, the electrodes must be kept clean or wide variations in results will be attained. Even so, there will be a certain amount of variation, depending upon the by-no-means constant length or course of the track, which appears in the test piece. This track is equivalent to a burnt pathway because the sample is carbonized by the passage of the arc. Most organic materials will emit acrid smoke from the test area just before the actual tracking takes place.

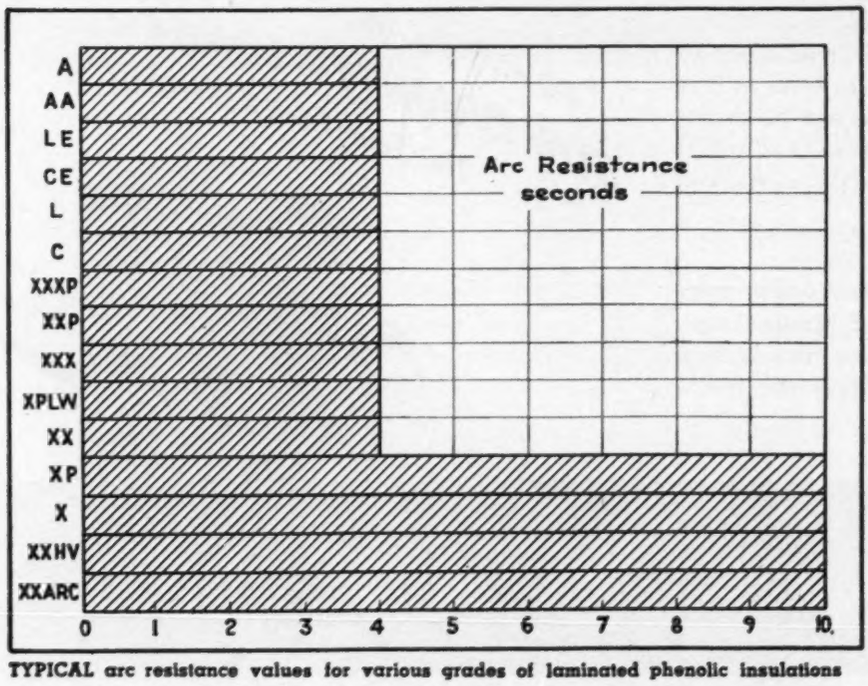
In most insulating problems the information obtained by this test is of no use whatsoever. But it becomes of vital importance in the case of such equipment as circuit breakers, or switches, or similar applications where there exists the possibility of arcing over the material. The arc should certainly not be formed through the material as readily as through the air, and the material should be of such a nature that arcs may, if necessary (or if accidental) flash across its surface without setting up a permanent track, which would allow conduction along this carbonized path and eliminate the usefulness of the dielectric; this possibility could be definitely dangerous. A high energy arc will of course cause tracking to take place much more readily than a low energy arc; this statement may seem obvious, but it not only stresses the fact that the insulation should be designed to match the equipment and the circuits but also covers the case where a low energy arc is coupled with surrounding requirements that may make it advisable to use a material whose arc resistance, *per se*, seems dangerously low.

When interpreting either test results or average values given for an insulating material, it is best to proceed with care. Unless the differences in values are on the order of 2 to 1, these differences are practically meaningless. With sufficient experience, and particularly if the actual testing itself can be observed, it is possible to draw finer distinctions, but in general any tendency to consider as significant results varying, for example, from a value of 10 to one of 14 seconds would be patently absurd except in the case of an arc of very low energy. This does not necessarily mean that test results cannot be listed as definite values, but rather that interpretation of such data should always be on the cautious side.

Sequence of Current Steps

Current, Milliamperes	Time Cycle	Approximate Rate of Heat Generation, Watts	Total Time, Seconds
10	¼ sec. on, 1 ¾ sec. off	3	60
10	¼ sec. on, ¾ sec. off	6	120
10	¼ sec. on, ¼ sec. off	12	180
10	continuous	24	240
20	continuous	34	300
30	continuous	45	360
40	continuous	56	420

*This series began in "Electrical World," December 11, 1943, issue.



TYPICAL arc resistance values for various grades of laminated phenolic insulations

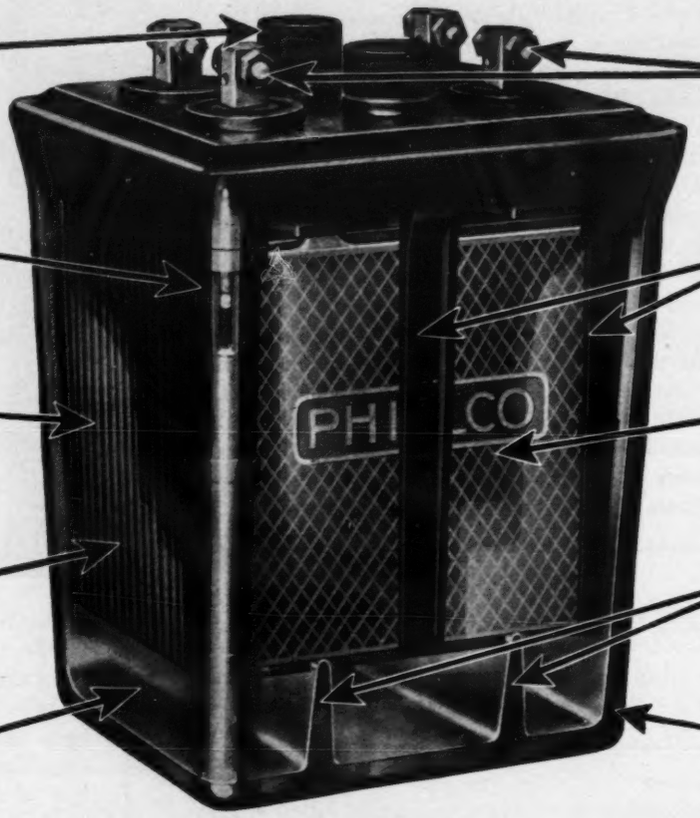
Post Insulators Best for Rebuilt Switches

Ordinary pin type insulators were being used in the rebuilding of air-break switches in the shop of the Alabama Power Company. A packing of lead was placed around the boss at the top of the insulator and a pair of steel half rings clamped on it to hold the working part of the switch. But it was found that temperature changes and switch operations would cause the clamp to become loose in a short time and frequent inspection and

Engineered specifically for modern full float service!

PHILCO FLOTÉ BATTERY

Philco Floté is the only battery design engineered specifically for the exacting requirements of modern full float charging! The Philco Floté grid of special metal not only retards peroxidation by exposing a minimum of grid metal on the plate surface, but it also provides superior conductivity and exceptional strength. This special metal and design reduces the amount of current necessary to maintain the charge *by as much as 40%.* Specify Philco Floté Storage Batteries for the most advanced engineering and rugged, dependable construction.


SPRAY-PROOF CONDENSING CHAMBER VENT. NO DAMAGE TO NEAR-BY EQUIPMENT
ACCURATE BUILT-IN INDICATORS SHOW STATE OF CHARGE AT A GLANCE
PHILCO FLOTE POSITIVE PLATES, HARD RUBBER RETAINERS AND DOUGLAS FIR SEPARATORS
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STEEL GLASS JAR, CAST AND ANNEALED, HALF-INCH THICK
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For Control and Stand-by service, Philco Floté Batteries in Steel Glass jars are available in cell capacities from 10 A.H. to 1056 A.H. In Philco Vitrabloc jars, capacities range from 240 A.H. to 1680 A.H. Write for the Philco Control and Auxiliary Power Battery catalog.

PHILCO CORPORATION, STORAGE BATTERY DIVISION, TRENTON 7 NEW JERSEY

SPECIFY PHILCO FLOTÉ BATTERIES

tightening of the ring were necessary in order to assure satisfactory operation. The trouble was cured by changing to a post or bus type insulator which has a cemented steel cap to which the switch part can be solidly attached with a simple adapter made to correspond with the tapped holes in the cap.

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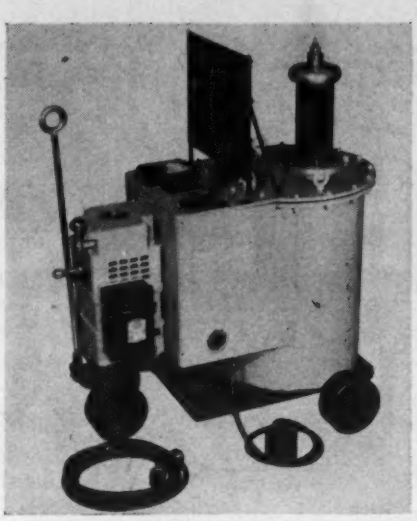
50-Kv. Set for Insulation Tests

By F. B. CAHALL
Power Transformer Engineering Division, General Electric Co., Pittsfield, Mass.

A 5-kva., 50,000-volt portable test set has been developed to provide a uniform increase and decrease of test voltage and with specific safety features. With this set electrical apparatus and insulating materials can be given high-potential tests that come within the current range of 0.1 amp. on the high side, corresponding to a capacitance load of 0.005 mf.

The single-unit set consists of:

(1) A 5-kva., 50,000—230/460-volt, single-phase, 50/60 cycle, oil-insulated transformer; (2) a 2.5-kva., 115/230-115/230-volt, single-phase dry-type induction voltage regulator; (3) a voltmeter with 25/50-kv. scales; (4) a voltmeter scale selector switch; (5) a two-pole air circuit breaker with magnetic over-current trip; (6) a safety-type line switch; (7) a foot-operated switch; (8) a red signal light; all assembled on a three-wheel truck with roller bearing wheels and composition tires. The set

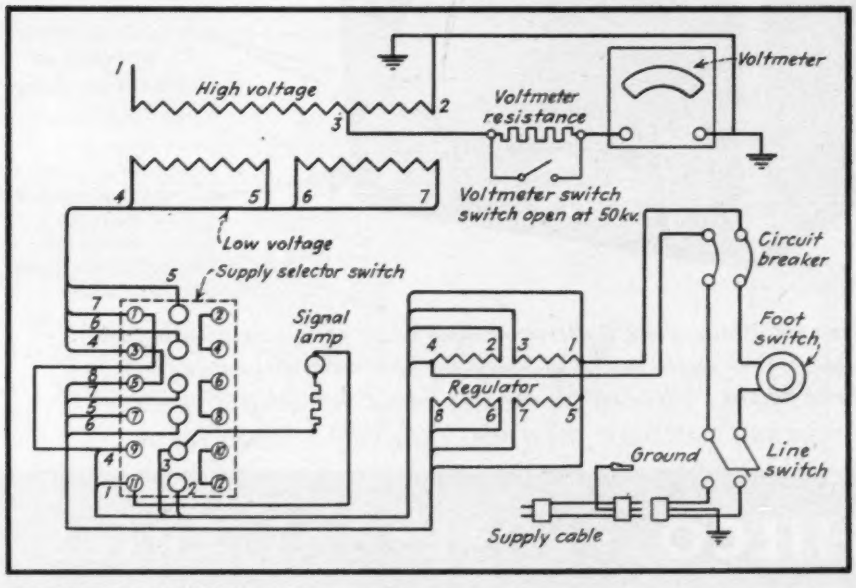


PORTABLE TESTING SET rated 5 kva., 50,000-115/230 volts

is intended for operation from either 115- or 230-volt circuits and a mere turn of a switch handle changes the connections. Connections of the set are shown in diagram below.

Transformer high-voltage winding is connected to ground at one end. The windings are shielded to prevent the development of high internal voltages caused by external surges or breakdown of the specimen under test. Neither choke coils nor resistors are necessary to protect the windings.

Voltage control is by means of the induction regulator designed for 100 percent raise and lower, which permits the voltage on the transformer to be varied between 0 and 50,000. The design of the regulator is such that the voltage output varies at a uniform rate provided the operating crank is rotated at constant speed.



CONNECTION DIAGRAM of 50 kv. testing set

A voltmeter coil is wound on the main transformer to give accurate indication of the actual test voltage under all conditions and is designed to produce 50 volts when the transformer is fully excited. It is connected to a switchboard type voltmeter with a double scale for voltages up to 25 kv. and from 25 to 50 kv.

For a safety guard a screen is placed between the operator and the 50-kv. bushing. To keep supply voltage on the set the foot switch must be depressed and a red signal light shows when the set is energized. The supply cable has a third wire for a ground connection.

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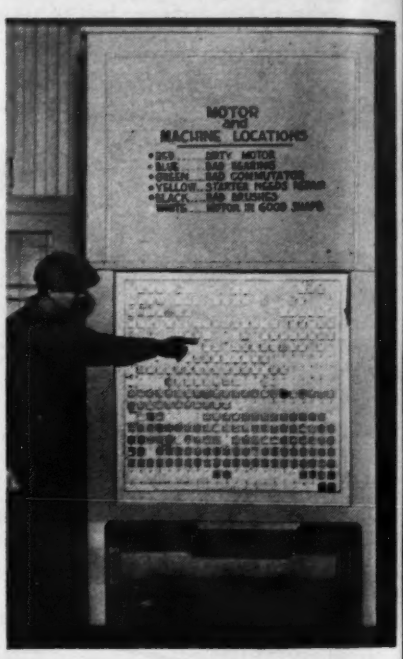
Board Guides Motor Maintenance



Condition of every motor in the La Porte, Ind., works of Allis-Chalmers can be checked in a few minutes at this "motor board," which helps keep routine maintenance at a wartime tempo. The cabinet holds a number of boards, each representing a shop and carrying stamped numbered metal tags representing specific motors.

The positions of the tags correspond to the motor's location in the shop. As motors are inspected or reports on their condition are received, these conditions are indicated by color-coded pins placed under the tags. The boards are movable up and down in the cabinet so that any one may be pulled down into view.

Sound product-planning . . . for present war-production or for future peacetime markets . . . demands the combined *best* of many specialized talents. Supplementing the counsel of specialists in other phases of such planning, the practical experience of The Mills of Mosinee frequently proves valuable in analyzing the services paper can perform best as an essential part of a wide variety of products.

Specially engineered Mosinee papers . . . made to meet *your* exact requirements . . . might improve product-utility, speed production in processing or assembly, replace critical materials, add new product-functions, lower your costs while raising product-value . . . because The Mills of Mosinee are equipped to control accurately the chemical and physical properties or characteristics of essential papers.

***With a Mosinee paper technician in that "vacant chair", opportunities for unusual new product-advantages might be disclosed.**

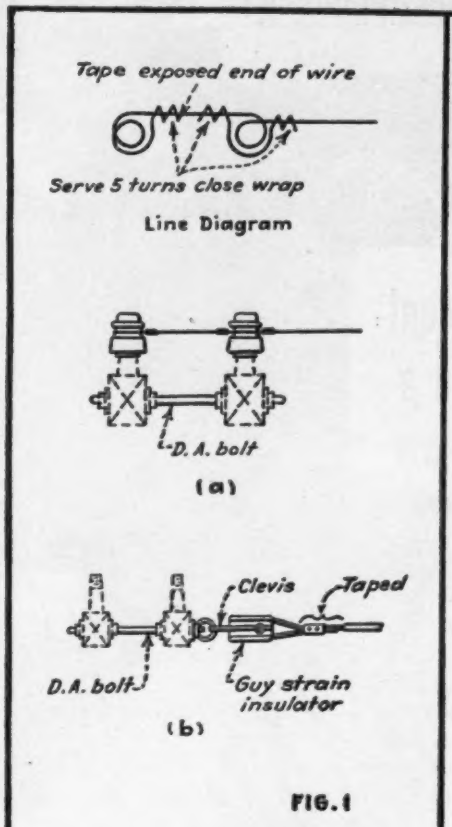
Please address your letter "Attention Dept. B"

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers

HOW TO MAKE SINGLE-WIRE DEADENDS

Methods for making single-wire deadends of various sizes of solid and stranded copper wires for 2,400- and 6,900-volt primaries, also secondaries. Existing double-arm bolts to be used wherever possible and center line of any double-arm bolt is to be 2 in. from pin center line.

Adaptation from construction standards of the United Illuminating Company, New Haven, Conn.



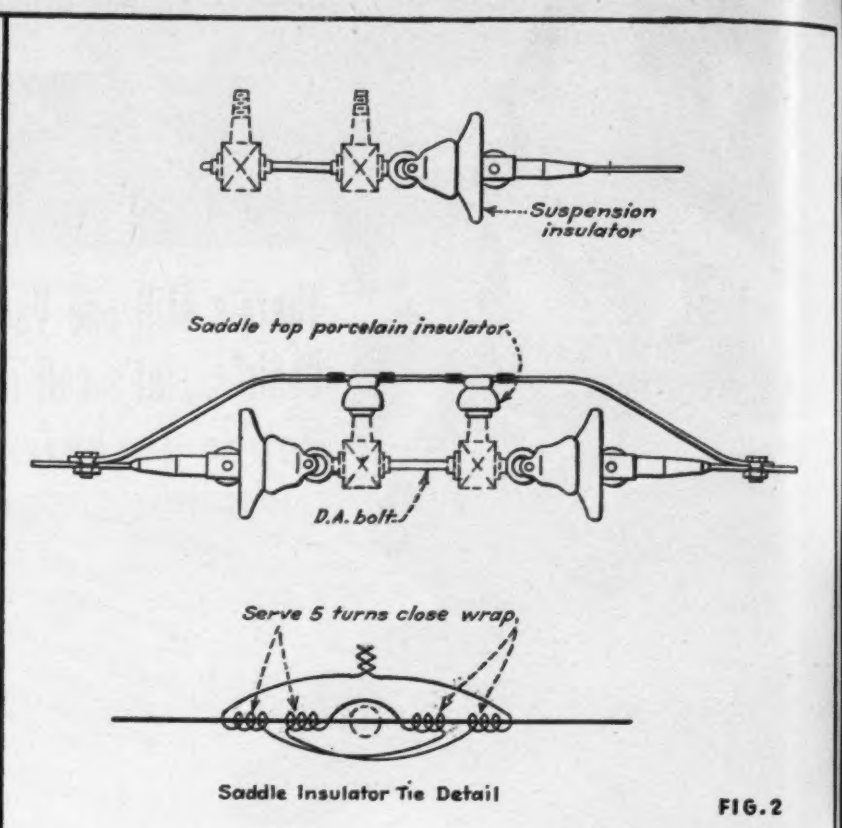


Fig. 1—For 2,400-volt primaries of (a) Nos. 6 and 4 solid wires, (b) Nos. 2, 2/0 and 4/0 stranded wire. Fig. 2—For 6,900-volt primaries of Nos. 2/0 and 4/0 stranded wire

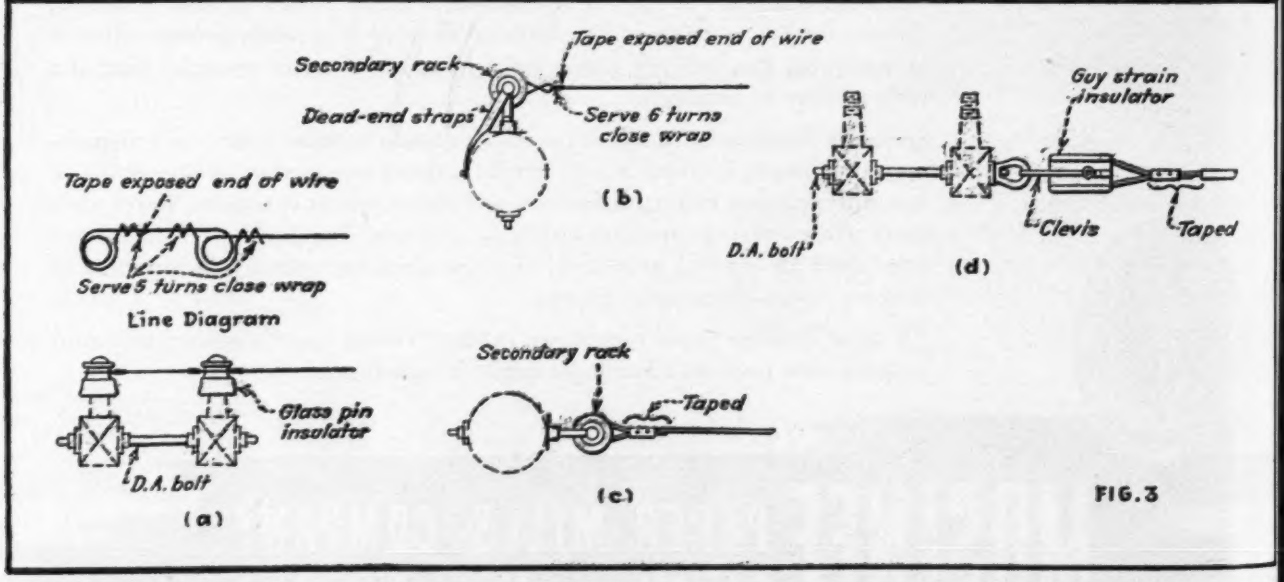


Fig. 3—For secondaries of (a) No. 4 solid wire, (b) No. 4 solid wire, (c) Nos. 2 and 2/0 standard wire, (d) Nos. 2, 2/0 and 4/0 stranded wire

EVEN THIS CONDITION

can't stop the dropout action of L-M PVD FUSE CUTOUTS

ecause their operation is entirely independent of any door ction. Thus, even if the door is solidly frozen shut, the PVD till operates as a disconnecting, dropout cutout. Because the oor remains shut, internal parts are always protected from the eather. When a link blows, the PVD cartridge drops down to rve as a positive indication of the cutout's blown condition, isible from any direction.

the PVD, when a link blows, the flip-out device instantly aps the unburned link leader clear of the cartridge, tinguishing the arc before the contacts separate. The large r-gap formed when the cartridge drops, prevents any arc re-tablishment.

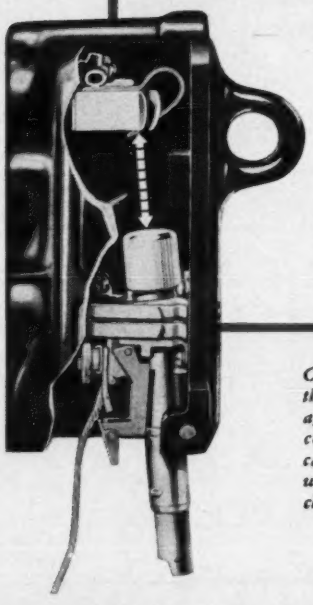
our L-M Field Engineer can tell you why this all-weather fuse tout will best suit today's conditions. Ask him, or write Line aterial Company, Milwaukee 1, Wisconsin.

There is a complete range of L-M PVD type fuse cutouts. They are available in the following sizes:

	Volts	Amp.
PVD-56	5000	50
PVD-76	7500/12500	50
PVD-515	5000	100
PVD-715	7500/12500	100

And for repeater service, having the same disconnecting, dropout action the:

	Volts	Amp.
RP2-56	5000	50
RP-515	5000	100



Cut-away view showing how the PVD cartridge drops out after the link blows, to disconnect and serve as an indication of the blown condition with the door remaining closed.

LINE MATERIAL COMPANY

Silences Phone Bells Temporarily

Good, strong bell or horn calls are necessary telephone appurtenances in the switchboard rooms of power plants and attended substations. But during a busy time when the operator is at one phone his hearing is not a bit improved by strident calls from two or three others demanding his attention. For this reason there is a neat little gadget in the floor below the operator's desk in the switchboard gallery of the Virginia Electric & Power Company. It is a foot push button such as is installed in the dining room floor in front of the hostess's chair so that she can signal the butler it is time to remove the mangled remains of the entree and bring on the pie.

If another telephone call explodes in his ear while, for instance, he is getting instructions from the load dispatcher to open section breaker No. 14 and transfer feeder No. 1208 to the auxiliary bus, he simply tramps on the floor button and the tumult is stilled. Before his eyes at the edge of the desk is a bank of indicator lights which tell him that one or more other phones are awaiting answer when he or another man on duty can get to them.

•

Expedient Design For Wartime Substation

Several substation design expedients, grounded in the present need for conserving critical materials and "making do" with available apparatus, mark as notable the arrangement of a recent 4,500-kva., 66,000/2,300-volt industrial substation on the system of the Oklahoma Gas & Electric Company.

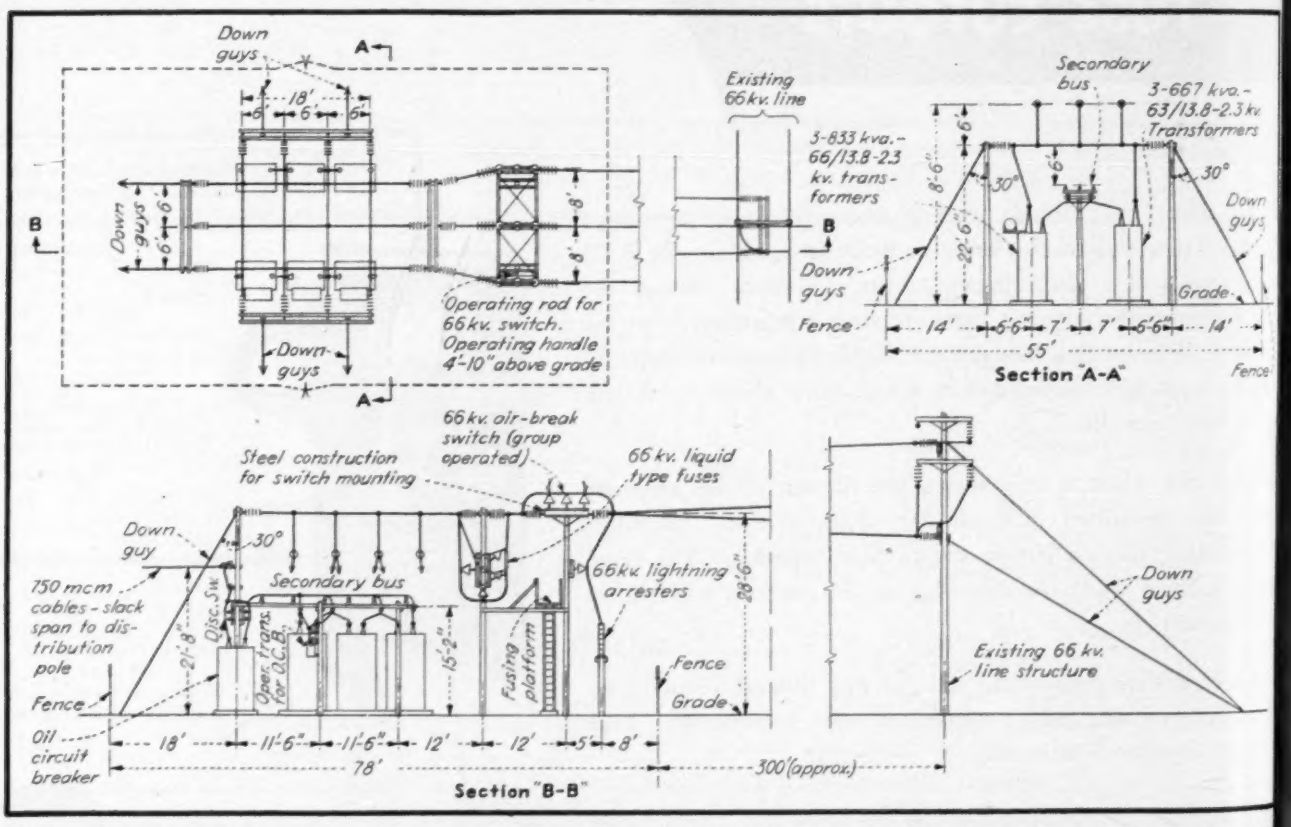
Use of an elaborate high-tension bus support structure in this substation was avoided by bringing the No. 1/0 line conductors into the station at normal conductor tension, extending them through the station as the high-voltage bus and balancing conductor tension by guying the "bus" at the opposite end of the station yard.

Instead of ordering a new bank of transformers for the stations, two parallel banks of existing available units were installed, one bank consisting of three 667-kva. transformers, the other of three 833-kva. units. Use of two banks instead of one led to the installation of a "cross bus," to which connections were made from the main bus by dropping "flying taps." The cross bus was guyed at both ends.

A single three-pole, gang-operated, 66-kv. air-break disconnect switch was used to disconnect both parallel transformer banks instead of separate three-pole disconnect switches for each bank. This avoided buying a switch for the purpose. Only serious sacrifice in this arrangement is convenience in removing banks from service for inspection and maintenance. On loss of a bank a service interruption will result whether separate switches are provided or not.

For the secondary bus, available 750,000-circ.mil bare cable was used, which was supported on a low, wood-pole, wood-beam structure at frequent points to eliminate unsightly sag.

The entire substation structure was of wood-pole and wood-beam construction with the exception of the 66-kv. group-operated switch mounting, which used available steel members. The substation fence was of conventional wood picket construction. Transformer and 1,200-amp., 2,300-volt oil circuit breaker foundations were of reinforced concrete. The substation inclosure was covered with about four inches of limestone screenings.



GUYED high-voltage bus: two transformer banks instead of one with single disconnecting means save equipment and materials in 4,500-kva., 66/2.3-kv. substation

JUNGLE DAMP'S A KILLER

The jungle's a dirty fighter. Vines and underbrush seem to grow across your way while you watch them. The sun doesn't get through...and it's damp. The heavy, hot kind of damp that means mildew and decay to every piece of equipment not specially made or treated to resist them.

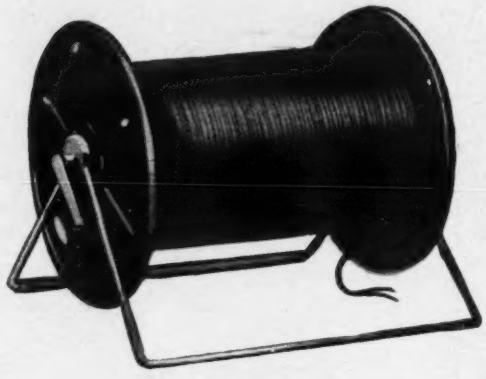
Laytex Assault Wire is specially made to resist damp. The high quality, uniform insulation is entirely free from water-soluble elements. It is unaffected by prolonged exposure to moisture, provides maximum protection to the accurately centered conductors.

Not only that...the special Laytex Insulation has high resistance to concussion and does not become embrittled when wire is subjected to repeated vibration and shock. It readily withstands temperature changes. Its uniformly high quality permits the thickness of the insulation to be kept at the minimum. As a result, Laytex Assault Wire is extremely lightweight. A mile weighs less than 30 pounds. Laytex Assault Wire has a talking distance of better than 5 miles, and was developed for front line service by United States Rubber Company scientists working in close cooperation with engineers of the Army Signal Corps.

These same properties—light weight, small diameter, ability to withstand temperature changes, flexibility and toughness make other types of Laytex Wires and Cables as important in peacetime industry and building as they are to the Armed Forces.

TALKING DISTANCE...OVER 5 MILES...
Laytex Assault Wire assures clear, sure transmission of messages—a prime military requirement for battlefront communications. An invaluable property when advance scouts have been cut off from their company and virtually surrounded in enemy territory.

LAYTEX ASSAULT WIRE IS LIGHTWEIGHT
...and fully dependable. One man carries enough wire to keep communications open—travels fast and far without being hampered by excess, needless weight.



Laytex
ASSAULT WIRE

SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

1230 Sixth Avenue, Rockefeller Center, New York 20, New York

MODIFIED CONSTANT POTENTIAL CHARGING, NICKEL-IRON-ALKALINE CELLS

Initial and final rates (on taper current) for various types of cells and recommended fixed resistance per cell to be placed in series with the battery for charging at d.c. bus potentials from 1.84 to 2.30 volts per cell

Bus potential, volts per cell	1.84	1.90	1.95	2.00	2.05	2.10	2.20	2.30
Initial rate (percent of normal)	165	155	147	140	134	128	124	120
Final rate (percent of normal)	65	70	74	78	81	84	86	88

Type of Cell	*Normal Rate Amps*	*Ohms per cell*							
A4	30.00	.00500	.00700	.00867	.01033	.01200	.01367	.01700	.02033
A5	37.50	.00400	.00560	.00693	.00827	.00960	.01093	.01360	.01627
A6	45.00	.00333	.00467	.00578	.00689	.00800	.00911	.01133	.01356
A7	52.50	.00286	.00400	.00495	.00590	.00686	.00781	.00971	.01162
A8	60.00	.00250	.00350	.00433	.00517	.00600	.00683	.00850	.01017
A10	75.00	.00200	.00280	.00347	.00413	.00480	.00547	.00680	.00813
A12	90.00	.00167	.00233	.00289	.00344	.00400	.00456	.00567	.00678
A14	105.00	.00143	.00200	.00248	.00295	.00343	.00390	.00486	.00581
A16	120.00	.00125	.00175	.00217	.00258	.00300	.00342	.00425	.00508
A20	150.00	.00100	.00140	.00173	.00206	.00240	.00273	.00340	.00406
A24	180.00	.00083	.00116	.00144	.00172	.00200	.00228	.00283	.00339
B1	3.75	.04000	.05600	.06933	.08270	.09600	.10933	.13600	.16267
B2	7.50	.02000	.02800	.03467	.04133	.04800	.05467	.06800	.08133
B4	15.00	.01000	.01400	.01733	.02067	.02400	.02733	.03400	.04067
B6	22.50	.00667	.00933	.01156	.01378	.01600	.01822	.02267	.02711
C4	45.00	.00333	.00467	.00578	.00689	.00800	.00911	.01133	.01356
C5	56.25	.00267	.00373	.00462	.00551	.00640	.00729	.00907	.01084
C6	67.50	.00222	.00311	.00385	.00459	.00533	.00607	.00756	.00904
C7	78.75	.00190	.00267	.00330	.00394	.00457	.00521	.00648	.00775
C8	90.00	.00167	.00233	.00289	.00344	.00400	.00456	.00567	.00678
C10	112.50	.00133	.00187	.00231	.00276	.00320	.00364	.00453	.00542
C12	135.00	.00111	.00156	.00193	.00230	.00267	.00304	.00378	.00452
D6	90.00	.00167	.00233	.00289	.00344	.00400	.00456	.00567	.00678
D8	120.00	.00125	.00175	.00217	.00258	.00300	.00342	.00425	.00508
D10	150.00	.00100	.00140	.00173	.00206	.00240	.00273	.00340	.00406
D12	180.00	.00083	.00116	.00144	.00172	.00200	.00228	.00283	.00339
G4	30.00	.00500	.00700	.00867	.01033	.01200	.01367	.01700	.02033
G6	45.00	.00333	.00467	.00578	.00689	.00800	.00911	.01133	.01356
G7	52.50	.00286	.00400	.00495	.00590	.00686	.00781	.00971	.01162
G9	67.50	.00222	.00311	.00385	.00459	.00533	.00607	.00756	.00904
G11	82.50	.00182	.00255	.00315	.00376	.00436	.00497	.00618	.00739
G14	105.00	.00143	.00200	.00248	.00295	.00343	.00390	.00486	.00581
G18	135.00	.00111	.00156	.00193	.00230	.00267	.00304	.00378	.00452
G22	165.00	.00091	.00127	.00158	.00188	.00218	.00248	.00309	.00370

(Edison Storage Battery, Division of Thomas A. Edison, Inc., West Orange, N. J.)

Veteran in Search of a Peacetime Future

THIS veteran knows of no job to come back to after the war.

It was born of war necessity — built to perform a strategic purpose new in the history of aircraft.

The requirements were an engineering challenge. It had to be strong to do its heavy work. Yet it had to be light and fit in the small space available.

That is why even optimists doubted such a device could be built.

But here it is: The Lear Actuator.

Its job is operating flaps, landing gears, shutters and other equipment on the power of an airplane storage battery.

Now, of course, our plants are working round the clock to make enough of these for the fighting ships of Uncle Sam.

But we know that such unique devices, the midget motors that drive them and all the 250 Lear products, must have an important future in some peacetime products.

They may park your car with the push of a button — or do any of thousands of jobs we haven't thought of.

That is why we are telling you about them. We want to find jobs for these able veterans.

And we want you to know that the kind of engineering thinking and production technique that made them possible is available.

PLANTS: Piqua, O., and Grand Rapids, Mich. BRANCHES AT: New York, Los Angeles, Chicago, Detroit, Cleveland, Providence.

Small . . . but MIGHTY!

. . . this 3-POUND MIDGET "MEGGER"* TESTER generates *500 VOLTS* and reads up to 50 Megohms

Basically designed for maintenance men, this mighty midget is used by many engineers for testing insulation resistance of practically all types of electrical equipment. Because it is small enough to fit an overcoat pocket or tool kit, and because of its instrument accuracy and machine ruggedness it has proved itself indispensable for maintenance and trouble shooting, even where higher range "Megger" sets are available. The hand cranked generator delivers 500 volts and since no batteries or external power supply are required, it is always ready for use . . . anywhere.

If you are not already familiar with this smallest and in many ways the most remarkable member of the "Megger" family, write for Bulletin 1545-W and Catalog 1685-W.

Trade Mark Reg. U.S. Pat. Off.

Ask also for Bulletin 1735-W describing the new U. S.-made "Megger" Testers.

JAMES G. BIDDLE CO.

1211-13 ARCH STREET • PHILADELPHIA 7, PA.

Wire Looping Jig Is Hand-Operated

By **HERBERT C. POTTER**

Manufacturing and Repair Department, Westinghouse Electric & Manufacturing Co., Chicago

A hand-operated fixture has been developed for looping wire for switchboard or control panel use; details are shown in the accompanying sketch (Fig. 1).

Chief merit of this fixture is its simplicity of design and low cost, thus making it available to the small shop which cannot afford a power-operated wire looping machine, of which a number of designs are available.

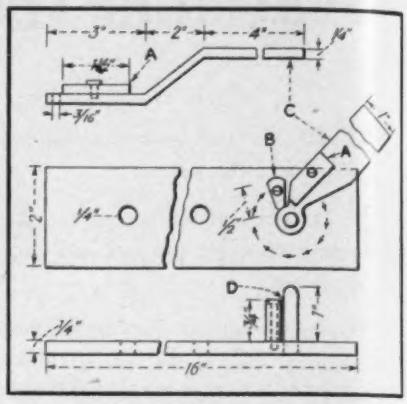


FIG. 1—Details of wire looping jig made of ¼-in. cold rolled steel

A—bending piece. B—Stop. C—Handle. D—3/16-in. stud for No. 14 and No. 16 wire; for larger wire A and B can be moved back.

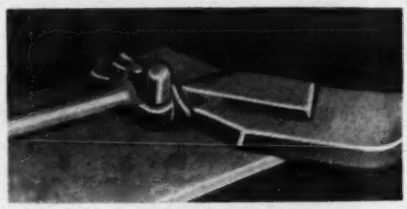


FIG. 2—Completing a loop with No. 12 wire

To form the wire loop the operator places the skimmed end of the wire in the jig with the left hand and pulls the handle of the fixture toward him with his right hand. Fig. 2 shows No. 12 wire being looped.

However, other sizes of wire can be looped by changing the stop B as shown on the sketch.

Loops formed in this jig are true circles and are formed without damaging the wire. By pre-forming the loops, wire can be shaped on a tem-

JOB PROVED

in thousands of installations

Central Rigid Steel Conduit will give long reliable service even under the most difficult conditions. Practical experience in thousands of installations has proven this time and again.

SPANG-CHALFANT

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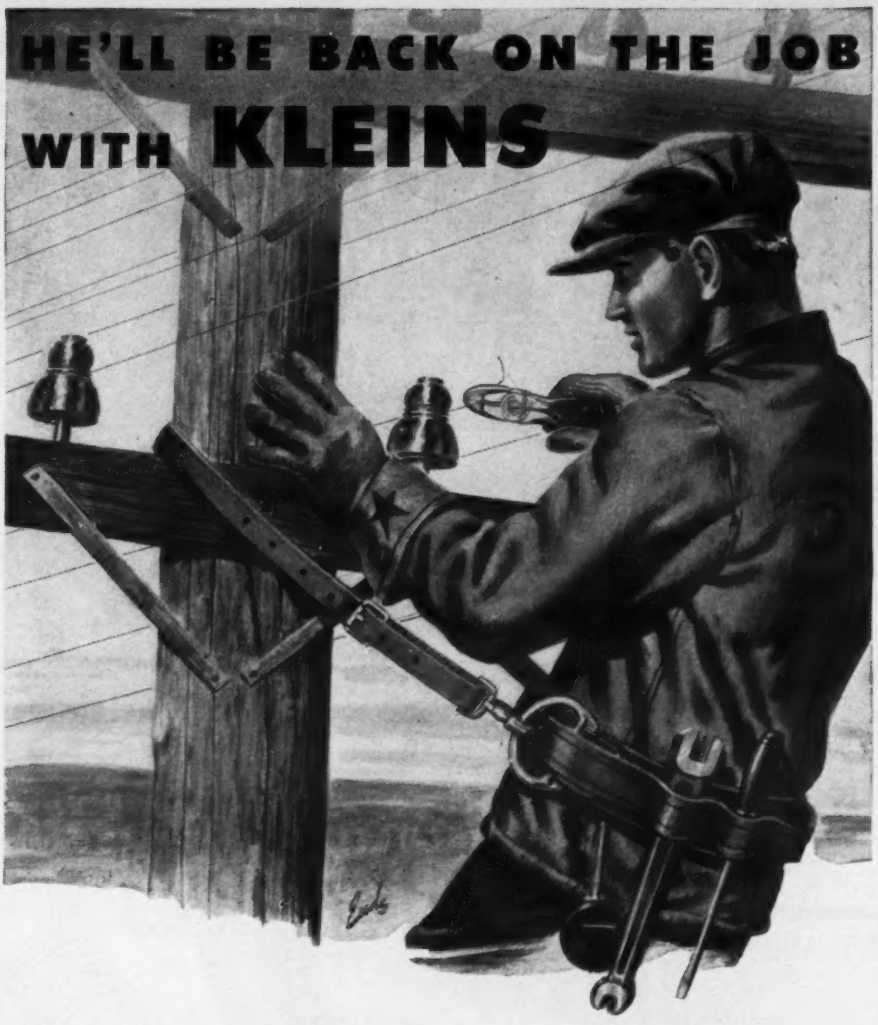


WHEN the war is won the planned program of communication and power line expansion will begin. The man on the pole will again be calling for Kleins.

He can be assured of the same high quality that has characterized the name Klein since the first wires were strung nearly a century ago.

Today, Klein production of pliers and tools, climbers and grips, safety straps and belts is greater than ever before. For this equipment is essential in keeping communication lines humming at home and on the battle front—in keeping power flowing to speed the world's greatest industrial production.

Tomorrow, public utility companies are assured that this stepped-up production will aid them in the important job ahead—providing better communications—greater power for an America at peace.

ASK YOUR SUPPLIER

Foreign Distributors:

International Standard Electric Corp., New York

Every broken tool is a break for Hitler! It is important that tools be properly used and properly cared for. The Klein booklet "Long Life to Tools" giving valuable information on the proper use and care of tools will be sent on request to anyone interested.

Since 1857

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
3200 BELMONT AVENUE CHICAGO 18, ILLINOIS

KLEIN TOOLS EST. 1857

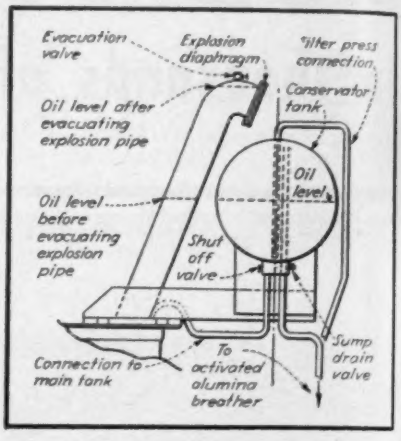
plate before being placed on the panel or switchboard, thus expediting the wiring of such panels.

•

How to Evacuate Explosion Vent Pipes

By E. H. COXE, Jr.
Electrical Engineer
Aluminum Company of America, Alcoa, Tenn.

Power transformers of the conservator tank type normally have an explosion vent extending above the conservator tank. This vent is in the form of an elbow with a glass diaphragm in its end. If the gasketed surfaces at the glass are made airtight, the entrapped air will be absorbed eventually (probably several months) by the oil and the vent pipe

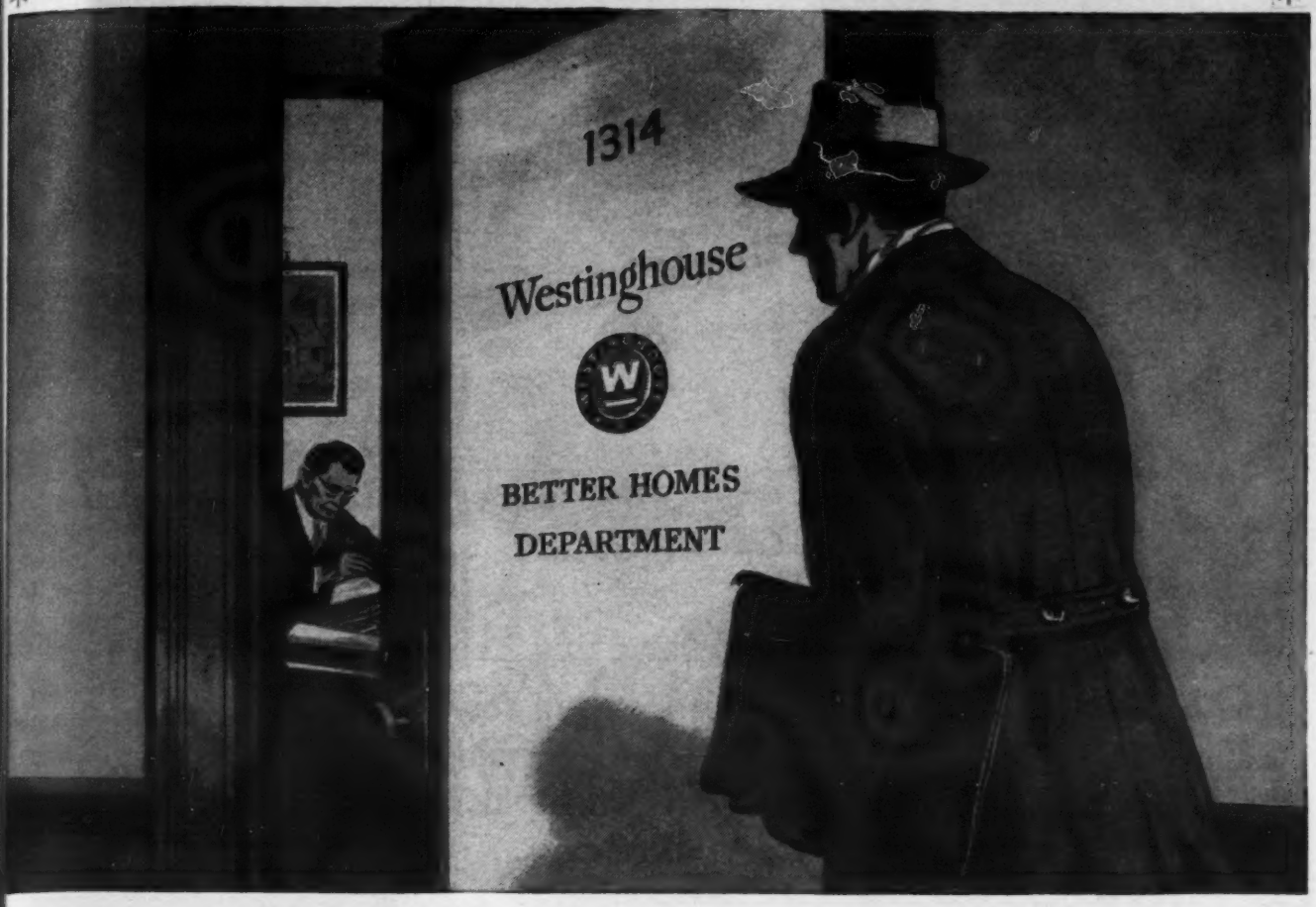


CROSS-SECTION of installation

filled, as will be shown by oil appearing back of the glass diaphragm. During that time there is opportunity for moisture to condense from the entrapped air and drop onto the winding or terminal boards, thereby partially overcoming the principal advantage of this type of transformer.

Furthermore, a leak at the diaphragm gaskets will allow breathing at this point, and thereby permit moisture to enter. This would counteract the benefit of the activated alumina air drier connected to the conservator tank breather pipe, which is designed to be the only contact point between the oil in the transformer and the outside air. One manufacturer suggests the application of slight air pressure to the transformer via the breather pipe and testing for leaks with a soap and water solution.

* BETTER WIRING FOR BETTER LIVING *



This door is always open . . .

YES, the door to the Westinghouse Better Homes Department is *always open* to assist the building profession in the planning of postwar housing.

The Better Homes Advisory Staff is ready and eager to give authoritative technical advice on the *proper applications of electricity* in 194X homes.

SIX-POINT ADVISORY SERVICE

The Better Homes Department offers a *Six-Point Advisory Service* on the following subjects:

1. Selection of correct types of electrical equipment for various classes of postwar homes.
2. Location and arrangement of fixed equipment, for conserving space and attaining maximum efficiency in arrangement of work cycles.
3. Accurate dimensions and clearances of equipment to insure proper installation and efficient operation.
4. Access for servicing of equipment—so necessary for periodic inspection and repair.
5. Location of lighting outlets and controls, for greater enjoyment, comfort, and safety in the home.
6. Utility service connections—including location and size of electric wiring, water supply, and drainage.

Westinghouse Better Homes Department welcomes the opportunity of giving constructive assistance to those interested in postwar housing.

If you have any problems relating to the selection, installation, and use of home electrical equipment, write: Better Homes Department, Westinghouse Electric & Manufacturing Company, Pittsburgh 30, Pennsylvania.

"ELECTRICAL LIVING IN 194X"

The Better Homes Department is preparing a new and unusual book—"Electrical Living in 194X" — which explains the urgent need for *better wiring for better living* in postwar homes.

This new book will be very helpful to the building profession and allied interests . . . in explaining to prospective home owners the importance of better wiring in their 194X homes.

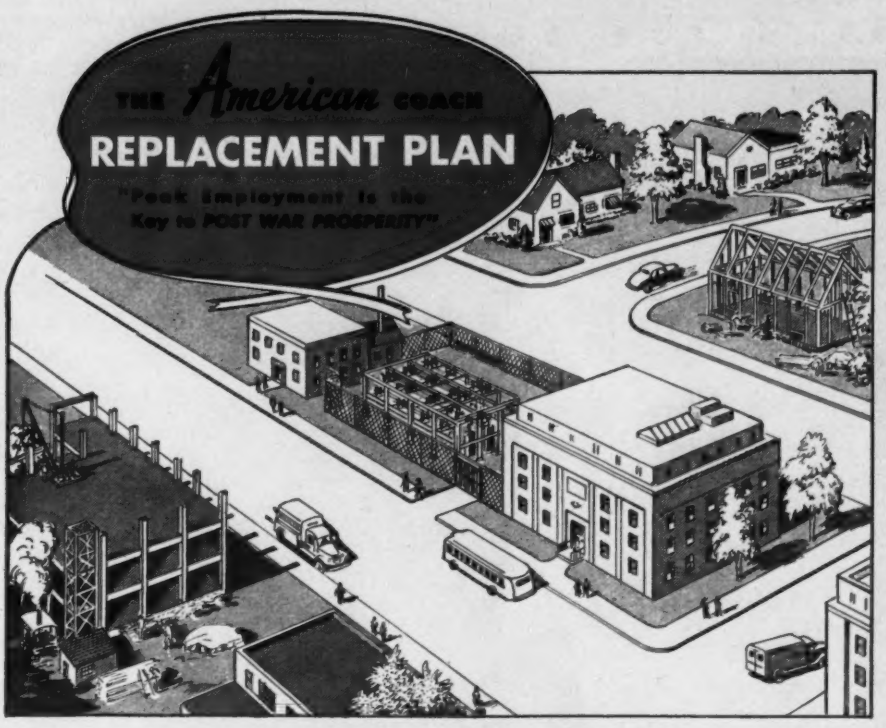
"Electrical Living in 194X" will be made available to public utilities, architects, engineers, contractors, builders, housing authorities, electrical inspectors, building management, and investment institutions.

Watch for further announcements regarding this colorful, easy-to-understand, 64 page book!

Tune in John Charles Thomas, NBC, Sundays, 2:30 p.m., E.W.T.

Westinghouse

Plants in 25 Cities ⊙ Offices Everywhere



The Above Represents A Post War Period Scene in Your Community, Will You Have the Equipment to Service the Communication, Light and Power Requirements?

THE AMERICAN COACH REPLACEMENT PLAN IS THE ANSWER

Today, practically all utilities find their automotive equipment considerably depleted. And it's reasonable, for they have had to keep, at tops, all services, and have had to do this with limited, practically irreplaceable equipment.

It is predicted that at least 20% of all utility trucks will have to be replaced within 12 months after "V" Day and that many additional new trucks and much new equipment will be needed to cope successfully with the construction of the many miles of new power and communication lines required to service the thousands of new homes envisioned for the post-war period.

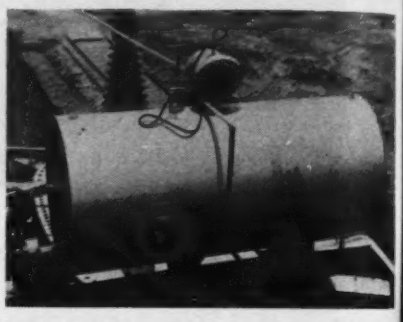
A large number of these trucks will need utility bodies and mechanical equipment such as is furnished by "American Coach."

Desiring to cooperate to the fullest with the Utilities and deliver the utmost in service, "American Coach," after a thorough field investigation and careful analysis has worked out a plan that will speed up, for the Utilities, the delivery of post-war equipment.

Let us send you full details regarding THE AMERICAN COACH REPLACEMENT PLAN. Write, Wire or Phone for it today.

THE American COACH & BODY CO.
PUBLIC UTILITIES EQUIPMENT FOR MOTOR VEHICLES

What appears to be a better method for testing for leaks at this point is being used at one large Southern substation. The top of the vent pipe elbow is drilled and tapped for a ¼-in. pipe nipple. A globe or angle valve is installed, with the pressure side toward the transformer, and a hand-operated suction pump is connected. A few minutes pumping will exhaust all air and completely fill the vent pipe with oil. A drop in the oil level, visible in glass cover on the explosion vent, indicates a leaking gasket. This arrangement has the added advantage of eliminating the absorption of several cubic feet of air by the oil, which would of course contribute to the deterioration of the oil. Since the vent pipe will be under negative pressure after the pumping operation, a defective gasket will cause air to leak in, permitting a drop in oil level back of the vent glass rather than permitting the oil to leak out.



VENT PIPE and evacuation equipment atop conservator tank

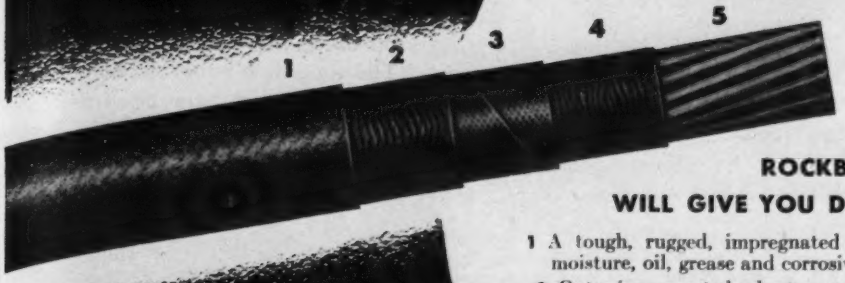
The oil level back of the vent glasses is checked monthly and any unexplained drop is investigated immediately and any defective gasket discovered at this time is replaced. The exposed edges of all gaskets are painted with a synthetic resin paint when installed. Repainting should follow at annual intervals.

The valve is left in place and plugged when the pump connection has been removed. The pump used has a bore and stroke of one inch and one foot respectively and was obtained from a manufacturer of chemical laboratory equipment. In construction the pump resembles a hand-operated tire pump with suction connection added. A cross-section of such an installation and a picture of the vent pipe and evacuation equipment are shown in the accompanying illustrations.

INSTALL POST-WAR WIRE NOW

Rockbestos A.V.C. Power Cable below and similarly insulated Motor Lead Cable (Underwriters' and Nat. Elec. Code, Type AVA) has a maximum operating temperature rating of 110°C. (230°F.) and a permanently insulated construction. See detail to the right.

For Long-Life in Circuits Exposed to Severe Conditions



WHY PERMANENTLY INSULATED ROCKBESTOS A.V.C. WILL GIVE YOU DURATION-PLUS SERVICE*

1 A tough, rugged, impregnated asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.

2 Outer impregnated asbestos wall which serves as a heat-barrier against high ambient temperatures.

3 Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat and flame by two impregnated asbestos walls.

4 Impregnated asbestos insulation withstands the heat of overloads up to the melting point of copper and won't ignite or burn.

5 The conductor is perfectly and permanently centered in helically applied insulation.

**One of 122 different wires and cables developed for severe operating conditions.*

ROCKBESTOS A.V.C. 600 VOLT MOTOR LEAD CABLE
(Underwriters' Type AVA)

Sizes No. 18 AWG to 1,000,000 CM insulated with two walls of felted asbestos and a high-dielectric, heat-sealed varnished cambric insert, covered with heavy asbestos braid.

Heatproof, fireproof, greaseproof and oilproof, will not dry out and crack, won't burn or carry flame, and remains permanently flexible. For coil connections, motor and transformer leads where extreme heat and fire hazards are encountered as in steel mills, etc.

ROCKBESTOS A.V.C. 600 VOLT SWITCHBOARD WIRE
(Underwriters' Type AVB)

Sizes No. 18 to 4/0 AWG with varnished cambric and felted asbestos insulation and gray, black, white or colored flameproof cotton braid.

Combine fire insurance and fine appearance in your switchboards with Rockbestos Switchboard Wire. It is absolutely fireproof and will not dry out under heat. Sharp, clean bends can be made without cracking as the asbestos wall acts as a cushion under the braid. Rockbestos A.V.C. Hinge Cable and Switchboard Bus Cable have the same fireproof and heatproof characteristics.

ROCKBESTOS INDUSTRIAL HEATING CABLE

No. 19 AWG nickel-chromium wire insulated with .040" of felted asbestos and covered with 4/64" waterproof lead sheath.

This pliable cable distributes a mild heat evenly over a large area. Prevents freezing of water pipes, wet pipe sprinkler systems, etc. Keeps conveyor pipes for fuel oil, soap, varnish, ink, chocolate, etc., at temperatures that insure steady flow.

WON'T bake brittle, burn, flow or rot.

RESISTS moisture, oil, grease and fumes.

Are you troubled with wire-failures in circuits that run around "hot-spot" locations such as furnaces, lehrs, boilers, steam tunnels, etc.? Do they seem to happen much too often? Then install Rockbestos A.V.C. *permanently insulated* wire and cable. It will not only give you freedom from wire failures for the duration, but will continue to provide trouble-free, dependable service for years to come.

Why does Rockbestos stand up? Because it has a *permanent impregnated asbestos insulation* that resists heat, flame, moisture, oil, grease and alkalies . . . and won't bake brittle, crack, bloom, rot, flow or swell. Start planning for the future as well as the present—install Rockbestos A.V.C. and forget your wire problems.

When inquiring or ordering, please furnish CMP allotment number or symbol with proper certification. For particulars and samples write nearest branch office or Rockbestos Products Corporation, 930 Nicoll Street, New Haven 4, Connecticut.

FOR VICTORY

★ ***Invest in United States War Bonds*** ★

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

LOAD SERVICING

Industrial • Commercial • Rural • Residential

Report on Results of Home Dehydration

By G. E. HENDERSON*
Assistant Chief
Agricultural Engineering Development Division, Tennessee Valley Authority, Knoxville, Tenn.

Home dehydration struck the public early in 1943 as a solution to wartime food preservatiou problems. Proponents and opponents alike hit the headlines in a battle of words over the merits and demerits of dehydration. Some confusion arose in the public mind over dehydration as related to drying when applied to food preservation. The public looked upon any equipment that would extract water from food as being a dehydrator, regardless of heat, air flow, humidity control or drying time involved. Actually it is generally agreed that dehydration and drying differ widely. Dehydration is the term applied when water is rapidly and uniformly removed from products under controlled conditions of heat, humidity and air movement. Drying is the removal of water by use of uncontrolled temperatures and without forced circulation of air.

Those with a sincere interest in the science of dehydration should be glad the early "hysteria" is over. They can now look realistically at the problem and co-operate in a mutual effort to its solution. First step is to learn what impressions have been gained by users of dehydrators (not dryers).

Last fall this organization, in cooperation with the Agricultural Extension Services of Mississippi, Alabama and Virginia, made more than 30 spot surveys of dehydrator users, plus many more by mail. Their impressions plus field observations, laboratory experience and reports and information supplied by the Nebraska, Ohio and South Carolina Agricultural Extension Services, the Nebraska and Oregon Agricultural Engineering Departments and the Tennessee Agricultural Experiment Station lead to the following comments:

1. A number of users who now appear satisfied with their dehydrated products will be dissatisfied when they use the products because they did a poor job of preparation, dehydration, packaging, storage, or all four. Some were guided by misinformation, or gained false impressions. Others canned or froze their best products and dehydrated their poorest.

2. Fruits such as peaches, apples, prunes and figs, and some vegetables such as corn, lima beans and okra, are accepted by users who have dehydrated them and followed good processing, packaging and storage practices. These vegetables are difficult to keep when canned and relatively easy to dehydrate. They are definitely superior in quality over sun or stove dried products. This makes it appear that dehydration has carved a niche in the over-all problem of home food processing.

3. Compared with freezing, home dehydration will not become popular with those who can afford the other service, unless dehydration technique can be simplified and improved over what it is now.

4. The marketing of a low cost ($25 or less), efficient and attractive dehydrator, as nearly automatic as possible, accompanied by effective instructions for processing, dehydrating, packaging, storing and refreshing, will greatly enhance the chances of dehydration becoming popular.

5. Improper packaging and too warm storage can easily be pitfalls for dehydration. Vapor-tight, lightproof and insect-resistant packages must be made readily available and the products stored where it is cool if quality is to be maintained.

6. Additional research is needed. Preparatory treatment, more accurate temperature and humidity control, methods for increasing speed of dehydration, new or improved packaging materials, improved dehydrater construction, better tray material and varietal adaptability, along with optimum stages of maturity of vegetables, are some of the research problems yet unsolved.

7. To compete with canning as an over-all method of preservation the dehydration processes need simplifying and over-all quality must be equal or superior to offset the longer preparation period before serving.

8. Technique in refreshing is definitely lacking with new users. Education and experience will gradually overcome this.

9. To those interested in low-cost food processing, dehydration ranks number one. According to the best figures we are able to get together, the over-all cost of processing and keeping 100 quarts in the home by freezing is $9, by canning $3.50, by dehydrating $2.70. These figures exclude labor.

General conclusions might be these: Home dehydration equipment will gradually replace the older method of drying, providing low-cost, efficient equipment in the form of fan-heater-thermostat kits or commercially built cabinets becomes available. Unless unexpected shortages of materials for home canning occur, there will not be a major change made during the war on home food preservation methods. The long-time program of home dehydration can only be linked with technical advances in this and other forms of food preservation.

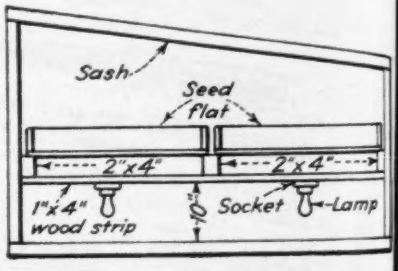
*Abstract of paper, "Report From Farm on 1943 Results With Home Dehydration," presented by author before fall meeting of American Society of Agricultural Engineers, December 7, 1943, Chicago, Ill.

•

Lamps Substitute for Cable in Hotbeds

An electric hotbed which utilizes regular Mazda lamps as a wartime substitute for hotbed cable has been designed by farm electrification men of Puget Sound Power & Light Company to aid victory gardeners to raise their vegetables from seed.

The lamp bulbs are spaced under the flats and the sockets are fastened with the mounting ends up to prevent water from draining off the flats into

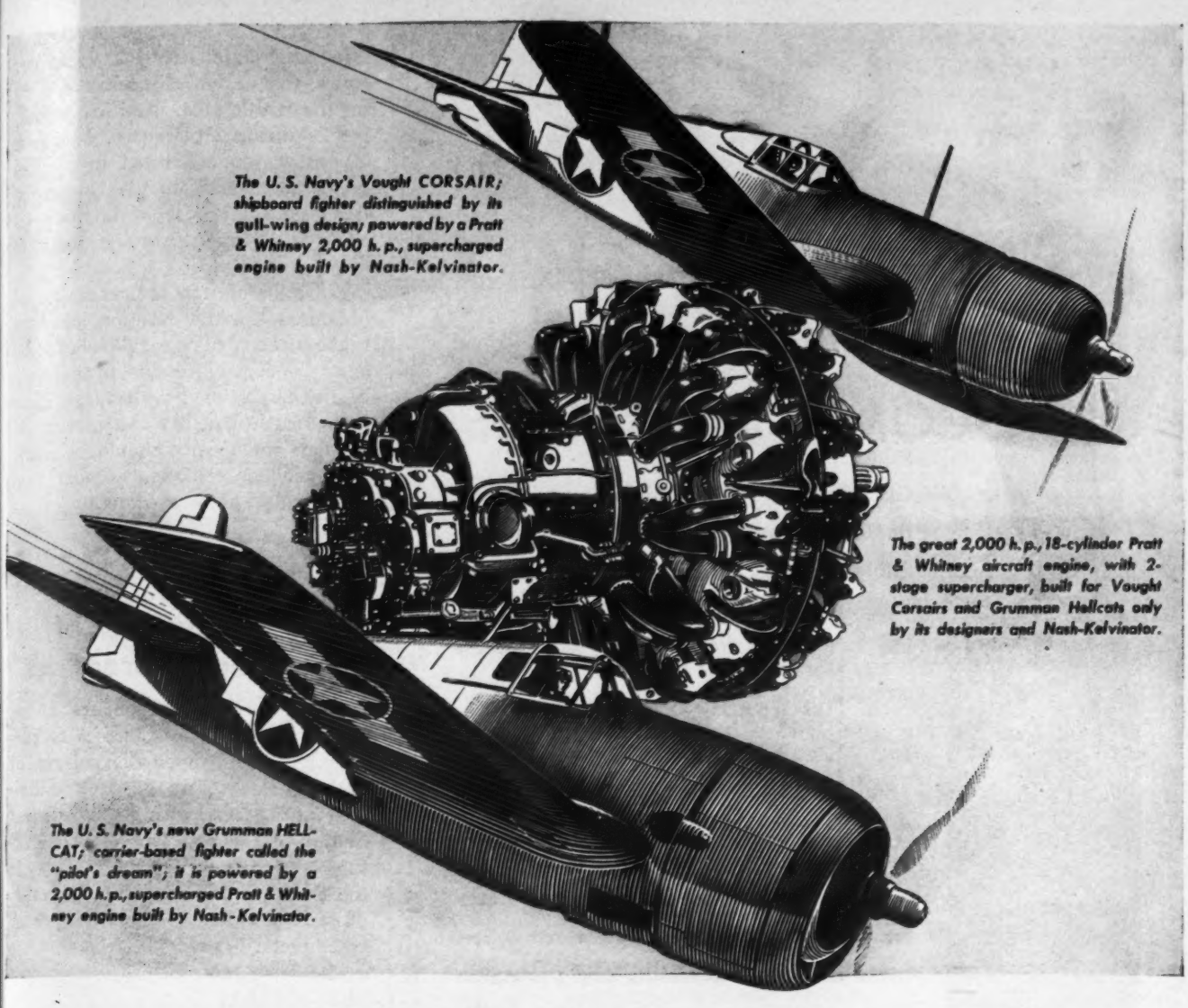


WARTIME electric hotbed designed to utilize lamps instead of cable for heating

the sockets. To allow room for the lamps the hotbed must be built deeper than types utilizing cable for heating. Drainage must be provided in the bottom of the bed.

Sockets or cleat receptacles are screwed to 1x4-in. wood strips which serve the dual purpose of supporting the sockets and protecting them from water. The strips are nailed under 2x4's used to support the flats. A distance of 10 in. should be allowed between the underside of the 1x4's and the bottom of the hotbed to allow room to screw in the lamps.

When figuring the required wattage climate must be taken into consider-



The U. S. Navy's Vought CORSAIR; shipboard fighter distinguished by its gull-wing design; powered by a Pratt & Whitney 2,000 h. p., supercharged engine built by Nash-Kelvinator.

The great 2,000 h. p., 18-cylinder Pratt & Whitney aircraft engine, with 2-stage supercharger, built for Vought Corsairs and Grumman Hellcats only by its designers and Nash-Kelvinator.

The U. S. Navy's new Grumman HELLCAT, carrier-based fighter called the "pilot's dream"; it is powered by a 2,000 h. p., supercharged Pratt & Whitney engine built by Nash-Kelvinator.

"DOUBLE Trouble" for the Axis . . .

Here are the U. S. Navy's Vought *Corsair* and Grumman *Hellcat* . . . two of the fastest, finest, toughest carrier-based fighter planes in the air today!

Detailed performance and design features of the *Corsair* and the *Hellcat* are Navy secrets, but . . . both planes have speeds in excess of 400 m.p.h. . . . both can fight at altitudes more than 7 miles above sea level . . .

And both are powered by 2,000 h. p. supercharged 18-cylinder Pratt & Whitney engines built in our plants!

It is no accident that these sleek bullets—breaking the back of Japanese air power in the Pacific with combat scores of 6-to-1, 8-to-1, 30-to-0—are powered by engines built in Nash-Kelvinator factories.

For the men and women of Nash-Kelvinator have long been proud of their craftsmanship and their ability to build products of high precision in quantity.

It is this precision craftsmanship . . . *this ability to build the finest in quantity* —whether it be famous Kelvinator refrigerators and electric ranges in peacetime or great aircraft engines in wartime —that makes certain, when peace comes, there will be a great new line of Kelvinator Refrigerators and Electric Ranges!

The men and women of the Propeller Division of Nash-Kelvinator Corporation have been awarded, and proudly fly and wear, the famous Army-Navy "E" for high Achievement in War Production.

LOOK AHEAD WITH KELVINATOR

DIVISION OF NASH-KELVINATOR CORPORATION

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● IMPERIAL NEOPRENE JACKETED PORTABLE CABLES ●

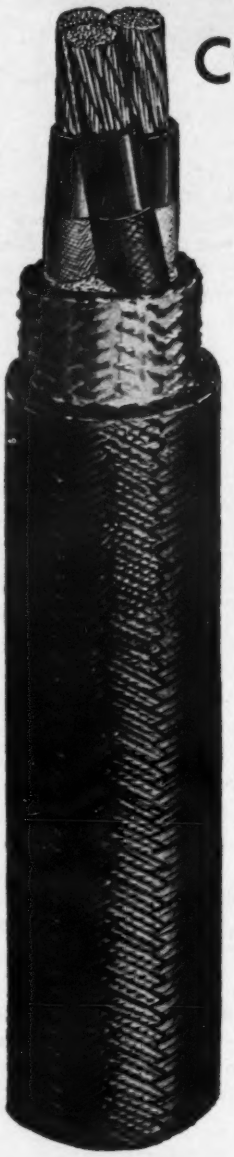
BUILDING WIRE ● SERVICE ENTRANCE CABLE ● CRESFLEX NON-METALLIC SHEATHED CABLE ● ARMORED CABLE

PERMACORD ● LEAD-ENCASED AND PARKWAY CABLES ● SYNTHOL WIRES ● WELDING CABLES ● SHIPBOARD CABLES

CRESCENT PERMACORD

Heavy Duty Portable

CORDS and CABLES



CRESCENT PERMACORD is a tough, flexible, heavy duty portable cord or cable for use on INDUSTRIAL portable drills, appliances, construction and mining machinery and welding equipment.

Durable—

The flexible, rubber-insulated copper conductors are enclosed in a protective jacket of rubber, vulcanized to an outer covering of heavy, impregnated, hard-twisted Seine twine. This construction gives maximum flexibility and protection from abrasion, crushing, heat, oils, greases and weathering. PERMACORD is made in sizes from #18 AWG to 1,000,000 CM, as well as in standard sizes of WELDING CABLE.

Proven in Service—

PERMACORD has been used for years principally by steel mills and mines for their most severe portable cable jobs.

CRESCENT INSULATED WIRE & CABLE CO.

TRENTON, N. J.

CRESCENT

WIRE and CABLE

● RUBBER POWER CABLES ● VARNISHED CAMBRIC CABLES ●

tion. Approximately 1.2 watts per square foot of hotbed is recommended for the Seattle area. In a 3x6-ft. hotbed requiring 216 watts of heat four 60-watt lamps connected in parallel are recommended to give even distribution. That size of lamp is selected as giving the wattage closest to that required.

Since thermostats are generally unobtainable for the duration, the heat in the hotbed can be regulated to some extent by controlling the burning time of the lamps or by changing their size. In constructing and placing of the flats some space should be made available between each so that heat can circulate above the flats.

•

Test Effectiveness of Lamp Heated Brooders*

Hoverless chick brooders using electric lamps with reflectors to furnish heat were made the subject of preliminary tests at the poultry division of the Agricultural Experiment Station of Texas A. & M. College during the spring of 1942. Objective of the tests was to determine the value of such brooders in situations where commercial brooders were either not available or too costly for small lots of 25-50 chicks.

In general it was found that this type brooder is satisfactory for emergency brooding of 25 to 75 chicks. It was found low in cost, simple to install and operate and utilizes a minimum of specialized equipment. Cost of operation is somewhat higher than with conventional brooders. Primary objection to brooding with a single lamp is the possibility of the lamp burning out during the night and causing the partial or total loss of chicks.

Three types of lamps were used in the tests: A 150-watt type R-40 Mazda lamp, a 250-watt type R-40 drying lamp and a 200-watt "Infra-red" lamp sold by the Lyon Rural Electric Company, San Diego, Calif., mounted in a 12-in. shallow-dome aluminum reflector.

Lamps were suspended from the ceiling at a height varying from 6 to 10 in. from the floor, depending upon the size of lamp. The height of the lamp from the floor was increased

*Printed with permission of P. T. Montford, Texas A.&M. College, College Station, Texas.

Results of FRIGIDAIRE GOOD-WILL BUILDING PROGRAM foreshadow bigger things to come

★ **THE STORY of a Wartime Plan which we sincerely believe is helping both the Public and the Frigidaire Dealer Organization.**

OUR OBJECTIVES

1. To cooperate with important Government programs.

2. To provide a real and needed service, not only to the millions of Frigidaire users, but also to the users of all other refrigerators.

3. To help keep the name Frigidaire before the public in a way that would be *favorably* remembered.

4. To help Frigidaire Dealers build good will and maintain their identity with the Frigidaire business.

THE PROGRAM

1. Consistent advertising in leading women's magazines.

2. Activities offering materials and other help to home economists and others for classes and study groups.

3. A simple, practical handbook on the use and care of a refrigerator, entitled "Wartime Suggestions".

4. A motion picture for group use entitled "How to Get the Most out of Your Refrigerator."

5. Effective dealer helps and campaign information.

WHAT DEALERS DID

Frigidaire Dealers built good will by—

- Giving Wartime Suggestions booklets to store visitors; mailing them to customers; leaving them on service calls.
- Arranging with thousands of Teachers, Red Cross, Group Leaders, County Agents, and many others to use the General Motors motion picture, and distribute books to these groups.
- Tying in the program with War Bond, Cooking School and similar activities in their stores.
- Distributing books through Boy and Girl Scouts, Ration Boards, Groceries and in many other ways.
- Featuring Frigidaire's helpful messages and booklets in attention-getting displays, and in their newspaper, radio and direct mail advertising.

THE RESULTS

- Over 245 million advertising messages attracting an unusually high percentage of women readers, have helped keep the public reminded of Frigidaire Products and Frigidaire Dealers.
- More than 6¾ million "Wartime Suggestions" booklets required to meet requests—more than 5¾ million of these distributed through Frigidaire Dealers.
- More than 625,000 booklets and 250,000 reprints of advertisements requested by Home Economists and group leaders.
- The free Motion Picture "How to Get the Most out of Your Refrigerator" has been seen by thousands.
- Hundreds of expressions of interest and appreciation have been received from Government agencies, Educators, Home Economists, Dealers and the public.

Watch for 44 Announcement!

t is on this foundation that Frigidaire has uilt a new and enlarged program for 1944. Vatch for the announcement!

For Excellence in War Production — ARMY-NAVY "E"

FRIGIDAIRE
Division of
GENERAL MOTORS
DAYTON 1, OHIO, AND LEASIDE, ONTARIO
Peacetime builders of
ELECTRIC REFRIGERATORS • RANGES • WATER HEATERS
HOME FREEZERS • ICE CREAM CABINETS
COMMERCIAL REFRIGERATION • AIR CONDITIONERS
BEVERAGE, MILK, AND WATER COOLERS

Listen to
GENERAL MOTORS
SYMPHONY OF THE AIR . . .
Every Sunday Afternoon,
NBC Network

★

LET'S ALL
BACK THE ATTACK!
BUY EXTRA WAR BONDS!

★

Westinghouse reports

to the Lighting Industry . . .

Predictions about tomorrow are plentiful. But in order to plan, you need more than predictions, you want the facts. Here, then, are the simple facts about tomorrow's Fluorescent Lamps, straight from Westinghouse designers, engineers and research men.

YOU WILL HAVE CIRCULAR FLUORESCENT LAMPS

Dimensions have been worked out, as indicated on the opposite page.

YOU WILL HAVE LONG, THIN FLUORESCENT LAMPS IN NEW SHAPES AND SIZES

Dimensions have been worked out, as indicated on the opposite page.

These new Fluorescent developments, pressed forward by Westinghouse research, will provide the Lighting Industry with a remarkable opportunity for expansion. They will bring Fluorescent light into the home—in portable lamps and new fixtures

☆ FOR LEADERSHIP IN LIGHTING . . . .

ABOUT TOMORROW'S FLUORESCENT LAMPS

that meet accepted standards of decoration and good taste.

They will open up new merchandising opportunities for stores, theaters, restaurants, hotels, office buildings, transportation terminals and other commercial enterprises.

We cannot tell you when these new lamps will be available, for Westinghouse manufacturing facilities are still heavily engaged in war work. But we will advise you as to their availability as far in advance of production as possible.

One more fact about tomorrow's Fluorescent Lamps. You can be sure that the Westinghouse name on a lamp will continue as a pledge of quality and dependability—assured by persistent Westinghouse research and engineering know-how.

Westinghouse Elec. & Mfg. Co., Bloomfield, N. J. Plants in 25 cities . . . offices everywhere.

WESTINGHOUSE MAZDA CIRCULAR FLUORESCENT LAMPS *Sizes to be produced and current consumption*

Approx. Overall Outside Diam. of Circle	Maximum Tube Size	Approx. Watts
8½ in.	1¼ in.	20
12¼ in.	1¼ in.	30
16 in.	1¼—1½ in.	40

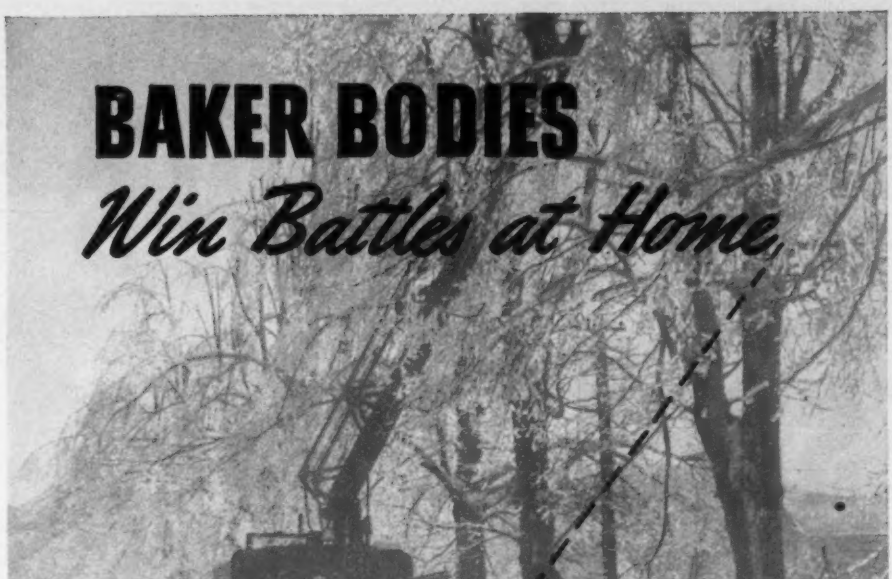
WESTINGHOUSE MAZDA LONG THIN FLUORESCENT LAMPS *Sizes to be produced*

Length Including Sockets	Approx. Tube Diameter
5½ ft.	½ in.
5½ ft.	¾ in.
5½ ft.	1 in.
7½—8 ft.	¾ in.

. . . WATCH **Westinghouse**

MAZDA LAMPS FOR SEE-ABILITY

BAKER BODIES
Win Battles at Home



Fire Fighter Pumper developed for emergency and national defense purposes.

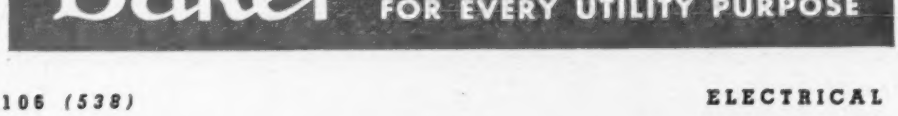
and on the Fire Line

● The call to battle is nothing new to Baker. For nearly half a century our aim has been to produce vehicles and equipment which will withstand the rigors of the service to which they are put in constructing and maintaining power lines. The experience thus gained is today serving our war effort, and all Baker facilities are now devoted to the production of special war equipment.

Utilities are commended for their excellent record in keeping their service trucks running when few replacements are available. A new, better line of Baker bodies is planned for post war. Let us know your needs today.

THE BAKER-RAULANG COMPANY

1284 W. 80th STREET *Utility Body Division* CLEVELAND, OHIO



Dependable AS THE SERVICE THEY HELP TO MAINTAIN

Baker BODIES AND EQUIPMENT FOR EVERY UTILITY PURPOSE

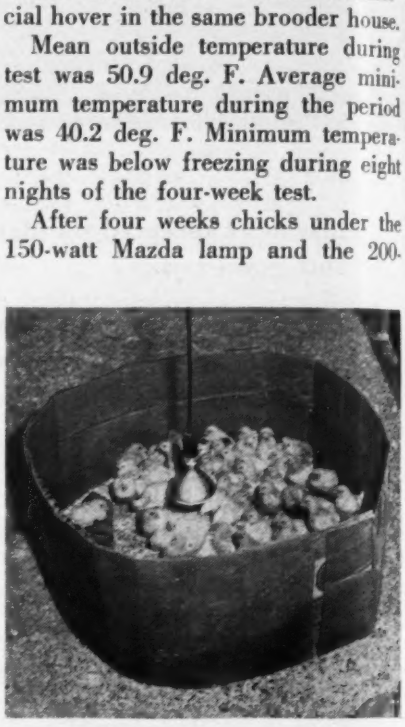
slightly as the brooding season progressed. A circular cardboard pen 14 in. high and 3½ to 4 ft. in diameter was placed around each lamp to prevent direct drafts on the chicks and aided in training them to stay near the lamp and feeders. The pen was removed when the chicks were one week to ten days old.

Fifty day-old chicks were placed under the 150-watt lamp, 66 under the 200-watt "Infra-red" and ninety-five under the 250-watt drying lamp.

The rate of growth and condition of the "experimental" chicks was checked against a group of similar chicks under a conventional commercial hover in the same brooder house.

Mean outside temperature during test was 50.9 deg. F. Average minimum temperature during the period was 40.2 deg. F. Minimum temperature was below freezing during eight nights of the four-week test.

After four weeks chicks under the 150-watt Mazda lamp and the 200-watt "Infra-red" weighed approximately 9 percent more than those under the check brooder. The chicks under the 250-watt drying lamp weighed 14½ percent less than those in the check brooder. All chicks under the lamps feathered out more rapidly than those under the conventional brooder. Mortality was approximately the same under all units. The low weight of the chicks under the 250-watt drying lamp was apparently due to overcrowding.



CARDBOARD WALL and R-40 250-watt drying lamp make effective hoverless brooder; wall is used during first few days to train chicks and prevent drafts and may be removed later

Effective heated area under the lamps is determined by the size and angle of the reflector. This area is approximately the same under the

50-watt R-40 and the 250-watt R-40. The lamps are mounted at a height o provide an optimum comfort zone t the perimeter of the heated area. The diameter of the heated area with he 150-watt lamp was approximately 4 in., while that of the 250-watt dry- ng lamp was only 18 in. The center of he heated area is too warm for chick omfort. If the height of the lamp is ncreased so that the area immediately nder the lamp is comfortable to the hicks, the effective area is reduced pproximately 10 in. in diameter. The temperature drops very rapidly mmediately outside the angle of re- lection.

During the test the lamps were on 5 percent of the time and the en- rgy used per chick under the 150- att Mazda lamp, the 200-watt "In- ra-red" and the 250-watt drying lamp as 1.92 kw.-hr., 1.94 kw.-hr. and .69 kw.-hr., respectively. The aver- ge use of electricity per chick under he conventional brooder was approxi- ately 1 kw.-hr.

In a second test 50 chicks were laced under the 150-watt type R-40 lazda lamp, 66 under the 250-watt -40 drying lamp and 70 under a 300- att Mazda lamp mounted in a 14-in. LM reflector. This test was contin- ed for four weeks and again the rate f growth and the condition of the hicks was checked against a group nder the conventional commercial rooder.

Second Test

The mean outside temperature dur- g the second test was 56.5 deg. F. he outside temperature dropped to 4 deg. on the first night of the test. his was the only time the outside mperature was below freezing. Out- de minimum temperatures were be- w 40 deg. on eight nights.

At the end of the test the variation weights of the chicks under the ree types of lamps was less than 2 ercent. The chicks under the lamps veraged approximately 5 percent eavier than under the check brooder. gain the chicks under the lamps eathered out more rapidly.

During the second test the lamps ere on approximately 75 percent of e time. The electricity used per hick was 1.52 kw.-hr. under the 150- att lamp, 1.91 kw.-hr. under the 250- att lamp, 2.16 kw.-hr. under the 300- att lamp and 0.8 kw.-hr. under the nventional brooder.

LIGHTING EQUIPMENT

For Industrial Needs

In spite of the heavy demands of war production, Silv-A-King—specialist in industrial lighting for close to a quarter-century—is regularly filling priority orders for both fluorescent and incandescent lighting equipment. Silv-A-King lighting units offer many advantages in over-all efficiency, easy installation and maintenance—and all equipment conforms to RLM and other recognized standards for high quality and efficiency.

Silv-A-King lighting service—which costs nothing extra—includes expert guidance in planning lighting layouts for maximum efficiency, flexibility, and economy. Why not discuss your lighting problems with a Silv-A-King engineer? *And send for the complete Silv-A-King catalog today!*

BRIGHT LIGHT REFLECTOR COMPANY, INC.
1035 Metropolitan Avenue, Brooklyn 2, N. Y.

Other SILV-A-KING *Products*

HIGH BAY MOUNTING UNITS
"HIM" MERCURY UNITS
ISLAND LIGHTS
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SILVERED BOWL DIFFUSERS
STOCK-AISLE REFLECTORS
VAPOR-PROOF LIGHTING UNITS
FLOOD AND SPOTLIGHTS

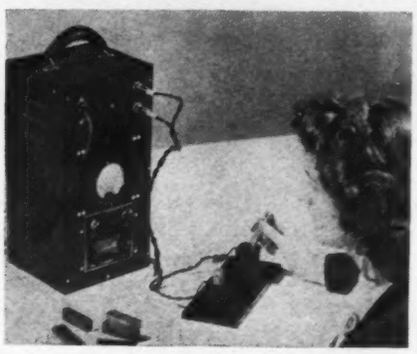
FLUORESCENT
SILV-A-KING
INCANDESCENT

SILV-A-KING MAKES *Light* WORK FOR YOU

NEW EQUIPMENT

Comparator

For controlling the quality of ferrous parts of the same size and shape new comparator detects any difference in the "standard" and "test" parts which changes the magnetic flux linking the coils surrounding them. Differences may be caused by wrong composition, improper heat treatment, hardness and size. The comparator consists of a variable-voltage transformer, sensitivity control rheostat, coarse and fine balance control rheostats, capacitors, zero-centered indicating instrument, and switches—all mounted in a steel case. Test fixtures are two air-core coils or two gage heads.



Portable magnetic comparator; hardness sensitivity two points Rockwell. **Special Products Division, General Electric Co.**, Schenectady, N. Y.

•

Capacitor

Latest type of the company's capacitors consists of liquid impregnated units housed in a wet process porcelain tube and filled with a liquid dielectric. End caps are the Westinghouse solder seal type which act both as a mounting arrangement and terminals. The units are built for total submersion for salt water and can be connected in series for operation up to several million volts.

Capacitor; rated 0.02 mfd., voltage ratings range from 7,500 to 250,000 volts. **Industrial Specialty Co.**, 1725 West North Ave., Chicago 22, Ill.

Voltage Selector

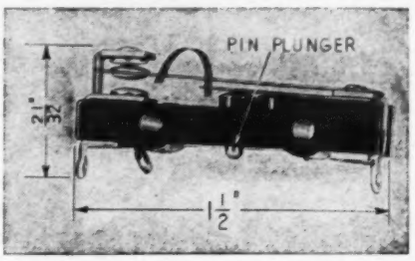
Magnetic voltage selector; step transfer from 2 to 40 volts. **Zenith Electric Co.**, 152 West Walton St., Chicago 10, Ill.

Inclosed panel has automatic main magnetic contacts and automatic main switch contacts for nine positions at 2.5-volt intervals. In the transfer operation the main contact opens before the secondary contact opens, and closes after the secondary contact is closed. Arcing is said to be effectually eliminated. The unit was originally developed for anodizing aluminum on a.c. supply.

•

Switch

Built on the rolling spring principle, small switch has snap-action spring and center blade made of beryllium and base of bakelite. It is designed for actuation from either the top or the bottom; only 4 to 6 oz. operating pressure is required. It is adapted to electronic control devices, electrical appliances and machine tools.



Midget snap-action switch; single pole, normally open, normally closed, and double throw with both pre-travel and over-travel provided; weight one ounce. **Acro Electric Co.**, 1340 Superior Ave., Cleveland 14, Ohio.

•

Welder

Model "LWL" portable gasoline-motor driven welding machine; ratings 200 to 400 amp. inclusive. **Libby Welding Co.**, 2700 East 15th St., Kansas City 1, Mo.

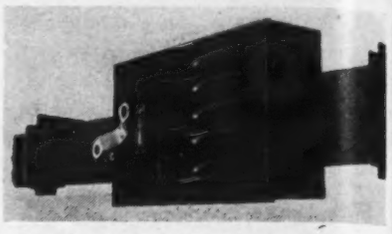
A line of portable welding machines includes units having a low center of gravity so that they can be used in rough terrain; these units have tool boxes and a lifting hook and are mounted on a welded chassis equipped with rubber tires and a towing attachment. Assemblies include Lincoln and P&H generators and Waukesha, Allis-Chalmers, Wylies Overland Jeep and Ford motors.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

•

Capacitors

Integral capacitor units for use with plug-in duct consist of 60-amp. three-pole switches or 15 to 50-amp. circuit breakers connected ahead of three-pole, single-unit capacitors having discharge resistors. To facilitate pull-chain operation from the floor, operating mechanisms are placed on the hinged covers over the protective devices. These units can be moved about readily as the load areas change.



Capacitor plugs; 230 or 460-volt, 60-cycle service; capacitor ratings 1 to 15 kva. **Bull Dog Electric Products Co.**, 7610 Jos. Campau Ave., Detroit, Mich.

•

Potentiometer

Model "431" Pyromaster self-balancing indicating-recording potentiometer; universal wall or flush mounting case. **The Bristol Co.**, Waterbury 91, Conn.

New model of indicating-recording potentiometer has an internal hinged panel mounting pen and indicator drive mechanism and control contacts or proportioning slide wire, or convertible-type air operated control mechanism. It has a standard cell type of manual standardizing circuit. Pen-drive motor is stated to give more torque for operating control contacts, especially under conditions of poor line voltage regulation. Indicating scale is a horizontal wide band. Stepping relays and slide wire in the potentiometer circuit are inclosed in a dust-proof bakelite housing.

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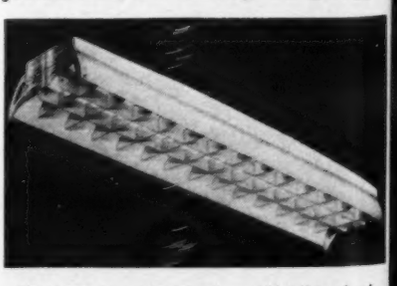
Luminaire

War-model 48-in. luminaire for offices and drafting rooms has open-type construction, vertical louvers and side wall surfaces, to prevent dust, dirt and bugs being trapped;



"Futurliter" eggcrate lamp-shielding luminaire; accommodates either two or three 40-watt fluorescent lamps. **The Edwin F. Guth Co.**, 2615 Washington Ave., St. Louis 3, Mo.

A Case of Identity

REQUISITES FOR LIGHTNING ARRESTERS

1. High Protective Level
2. Ability to Carry Heavy Surge Current
3. Good for Both Long and Short Wave
4. No Breakdown on Normal Current
5. Moisture Proof *
6. Operate in All Climates
7. Long Life
8. Field and Laboratory Success
9. Ability to Prevent Line Lock-out
10. Operating Characteristics Unchanged Over Long Service

The men illustrated above are three Electrical Engineers and a Purchasing Agent. These men collaborated in preparing the list of "Requisites for Lightning Arresters" shown at the left. The list was recently published and distributed by a leading Electrical Trade Paper.

* No. 5 was unanimously voted most important.

OPERATING MEN ASK FOR IT!
HUBBARD AUTOGAPS HAVE IT!*

Hubbard Autogaps Have the Answers

1. Yes! Rapid operation — characteristics are fixed. Breakdown point 55% of insulation strength of equipment.
2. Excellent! In excess of 65,000 Amperes of surge current without failure.
3. Yes! Handles Long and Short Waves with equal ability.
4. No! Gap settings are above possible 60 cycle voltages.
5. Better than moisture proof. Design characteristics for Expulsion Type Arrester not affected by moisture.
6. Yes! High and low altitudes — high and low temperatures have not affected good performance.
7. Yes! Made entirely of time-tested, durable material — virtually unaffected by each operation.
8. Excellent laboratory performance confirmed by several years field experience.
9. Yes! Multiple gaps in series containing *no fusible material.*
10. Field experience proves unchanging values over long period of service. Oscillograms are available.

In other words . . . these four men might well have written a single word on their list . . . "Autogaps"

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PITTSBURGH . . OAKLAND CALIFORNIA CHICAGO

THE BLACKOUT THAT *Prevents* A BLACKOUT!

PLUS-FIFTY DUGAS Dry Chemical works amazingly fast in "blacking out" fires in electric power equipment. But equally important, PLUS-FIFTY DUGAS Dry Chemical kills fire without injuring vital equipment not already damaged by fire.

Bringing new fire-fighting speed when speed counts most, PLUS-FIFTY DUGAS Dry Chemical also offers a new degree of safety because its greater fire-smothering action means reduced danger from flash-backs. And PLUS-FIFTY DUGAS Dry Chemical is a non-conductor of electricity.

Want the complete story of PLUS-FIFTY DUGAS Dry Chemical as well as priority information on DUGAS Fire Extinguishing Equipment? Write today for quick service.

Approved by Underwriters' Laboratories and Factory Mutual Laboratories.

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CHART showing comparative characteristics of all types of approved hand fire extinguishers, sent free on request.

MODEL 150 WHEELED EXTINGUISHER

DUGAS ENGINEERING CORPORATION, MARINETTE, WISCONSIN

OWNED AND OPERATED BY ANSUL CHEMICAL COMPANY

the unit is designed for close ceiling or ceiling suspension and can be mounted singly or end to end in continuous runs for 50- or 75-foot-candle installations. Conventional ballasts with starter switches or Quick-Liter ballasts without starter switches can be furnished.

Insulation

Formulation "S" plastic tubing; clear; range of sizes, inside diameter 0.020 to 3 in., wall thickness 0.012 to 0.034 in. or as desired. **Surprenant Electrical Insulation Co.**, 84 Purchase St., Boston, Mass.

Tubing of a polyvinol compound has been designed for transparency and to give flexibility at sub-zero temperatures. It is stated to have a high resistance to mineral and fatty oils, greases, waxes and most solvents, and to be unaffected by dilute acids, alkalies, salts, weak bases and organic acids. Some other properties are:

Dielectric strength, v.p.m., avg.	1,250
Power factor, %, 25 deg. C., as received	
60 cycles	5.2
1 megacycle	7.5
Dielectric constant, 25 deg. C.	
60 cycles	13.4
1 megacycle	8.5
Tensile strength, psi, avg.	2800
Elongation at rupture, %, avg.	375
Melting point, deg. F., avg.	370
Cold test (low temperature flexibility), deg. F.	minus 45 to 70 max.

TECHNICAL LITERATURE

PLASTICS—Properties and applications of over 30 grades of a structural plastic, Panelyte, also information on gluing and references to NEMA, Army, Navy and Federal grades, are included in a series of engineering bulletins available from Panelyte Division, St. Regis Paper Co., 230 Park Ave., New York, N. Y.

FLOW METERS—A 16-page booklet gives information on why, when and where flow meters and instruments are needed in the modern plant. Basic metering data is covered. Drawings provide details of installation methods. Hints are included for keeping instruments out of the repair shop. Publication 29, "Flow Meter Engineering" is obtainable from Cochrane Corporation, 17th and Allegheny Ave., Philadelphia 32, Pa.

BALL BEARINGS—"Service Procedure for Ball Bearings" gives in simple terms the steps from dismounting, cleaning, judging condition, to remounting, fully described and illustrated with drawings and photographs. Copies of booklet ND-A57 may be obtained in a reasonable quantity from New Departure Division, General Motors Corp., Bristol, Conn.

PLASTICS—Seven types of materials that are extrudable in various shapes, a brief description of each, their physical properties and their fabrication are outlined in a 12-page booklet, "Plastics," obtainable from Carter Products, Inc., 6921 Carnegie Ave., Cleveland 3, Ohio.

RADIANT HEATING—An outline for infra-red radiant heating applications such as in paint drying, metal control, wood working, textile industry, plastics, glass and ceramics, rubber and paper and foundries, is contained in a booklet "Infra-Red at Work," obtainable from C. M. Hall Lamp Co., 1035 East Hancock Ave., Detroit, Mich.

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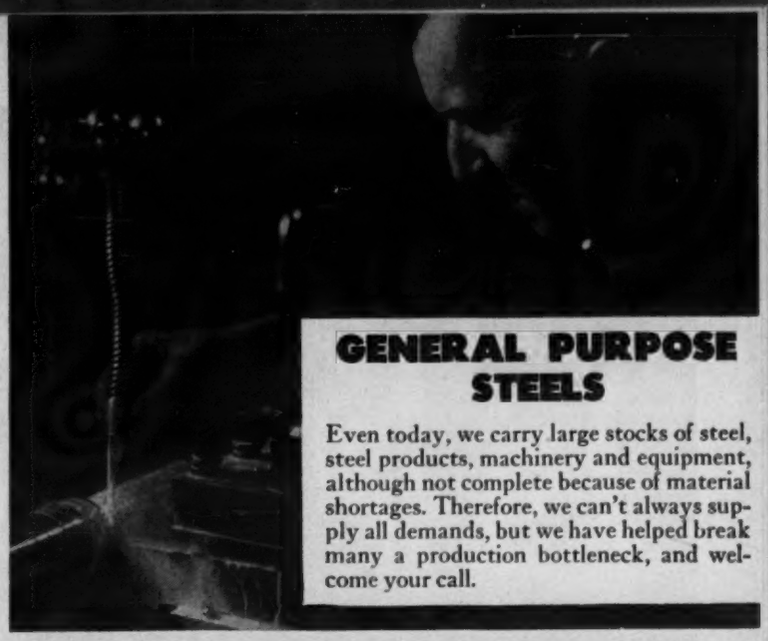
all to us may solve your problem. Our job is to keep war duction moving, so if you need steel, we'll get it to you hurry, if at all possible—subject, of course, to priority ulations. We will appreciate receiving your inquiries—ne, write or wire our nearest warehouse. You'll get mpt, courteous attention.



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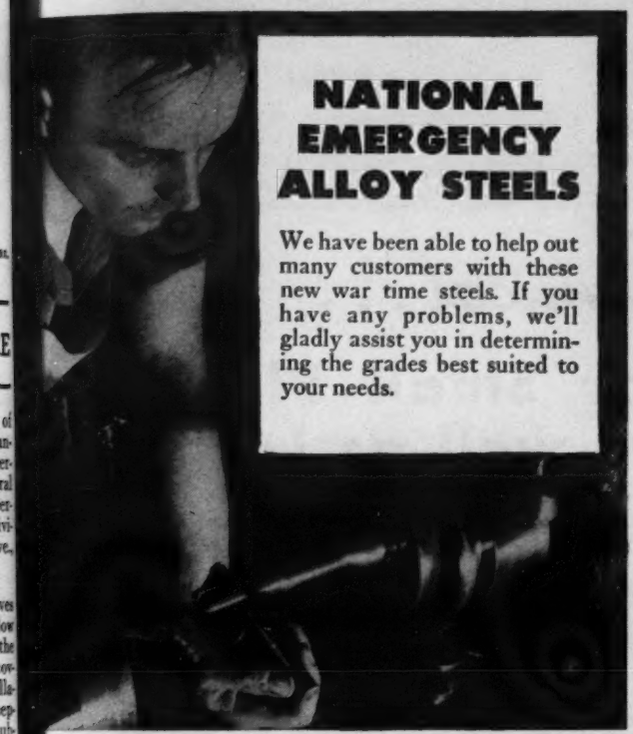
Even today, we carry large stocks of steel, steel products, machinery and equipment, although not complete because of material shortages. Therefore, we can't always supply all demands, but we have helped break many a production bottleneck, and welcome your call.



NATIONAL EMERGENCY ALLOY STEELS

We have been able to help out many customers with these new war time steels. If you have any problems, we'll gladly assist you in determining the grades best suited to your needs.

FOR WELDING NEEDS

We can supply Welding Wire for electric arc welding, such as:

STAINLESS STEEL ELECTRODES
HARD-SURFACING ELECTRODES
MILD CARBON ELECTRODES

We also offer Welding Machines, Protect-O-Metal for elimination of weld spatter and Havens "C" Protected Clamps. Write, phone or wire our nearest warehouse.

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LTIMORE (3),	Bush & Wicomico Sts., P. O. Box 2036	Teletype BA. 183	GILmore 3100
STON (34),	176 Lincoln St., Allston, P. O. Box 42	Teletype BRTN. 10	STAdium 9400
EVELAND (14),	1394 E. 39th St.,	Teletype CV. 153	HEnderson 5750
LWAUKEE (1),	4027 West Scott St., P. O. Box 2045	Teletype MI. 587	Mitchell 7500
WARK (1), N.J.,	Foot of Bessemer St., P. O. Box 479	Teletype NK. 74	Bigelow 3-5920
			REctor 2-6560 · BErgen 3-1614
TSBURGH (12),	1281 Reedsdale St., N. S.	Teletype PG. 475	CEdar 7780
LOUIS (3),	21st & Gratiot Sts.,	Teletype SL. 384	MAin 5235
N CITY,	2545 University Ave., St. Paul (4), Minn.	Teletype STP. 154	NEstor 2821

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UNITED STATES STEEL

Ⓕ Busduct System installed in a small laundry.

Economical . . .

for Small Plants as well as Large

Some plants have been equipped with miles of

Ⓕ BUSDUCT

Many small ones have required a hundred feet, or even less. And, of course, there are many "in-between." In every case, however, the installation of this convenient and flexible method of Ⓕ Busduct distribution for electric light, heat and power has been accomplished at surprisingly low cost.

Both Feeder and Plugin Ⓕ Busduct may be taken down and moved to new locations without appreciable loss of material. Standard sections, with pull boxes, elbows, end closures, tees and crosses, make it possible to fit any desired arrangement, so that changes in location of machines is rendered easy.

Designed for 2, 3 and 4 wire systems, 575 volts AC, maximum.

Ⓕ Busducts are now made under W.P.B. Limitation order L-273. They have the same basic features of construction as the standard model.

The Ⓕ Sales-Engineer Can Help You

in planning and designing an efficient and convenient Ⓕ Busduct Distribution System. No obligation, of course. Bulletin 65 (and supplement) give full details. They will be sent promptly on request. . . . . Frank Adam Electric Company, P.O. Box 357, St. Louis, Missouri.

EST. 1891 THE SIGN OF A BETTER JOB

Frank Adam

ELECTRICAL PRODUCTS
for War Industry

FRANK ADAM ELECTRIC CO. ST. LOUIS, MO. U.S.A.

NEWS ABOUT PEOPLE

Electric and Gas Group Elects O'Brien Head

S. J. O'Brien, president of S. J. O'Brien Sales Corp., was elected president of the Electrical and Gas Association of New York, Inc., at the recent annual meeting.

Other officers elected were: Vice-presidents, T. F. Barton, General Electric Co.; T. H. Joseph, E-J Electric Installation Co.; Norman L. Myers, Westinghouse Electric & Manufacturing Co.; C. Calahan, General Electric Supply Corp.; treasurer, James A. Sackett, Kings County Lighting Co.; secretary, A. Norton, Pierce Laboratory, Inc., and assistant secretary, John W. Walter, Apex Rotarex Corp.

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GWILYM A. PRICE, vice-president of the Westinghouse Electric & Manufacturing Co., has been elected a member of the board of directors of the Pittsburgh Steel Co.

JAMES S. CARSON, vice-president of American & Foreign Power Co., Inc., is elected president of the Argentine-American Chamber of Commerce, at the directors' annual organizational meeting held recently in New York.

HAROLD D. CONKLIN has been appointed manager of the range and water heater sales division of the Edison General Electric Appliance Co., Inc., Chicago. Mr. Conklin returns to that city after nine years in Los Angeles as Hotpoint district sales manager for the Pacific Southwest, which includes nine states and the Hawaiian Islands. He has been with Hotpoint during his entire business career of fiteen years, having previously held two assistant manager positions in Chicago. While on the coast Mr. Conklin was president of the Electrical Development League of Los Angeles and also held membership in the Los Angeles Sales Managers' Club.

H. E. BIXBY of Portland, Ore., has been appointed chief of the regional branch of power utilization for the U. S. Bureau of Reclamation in connection with the Central Valley project in California. Mr. Bixby will be responsible for operating and maintaining the electric power generation, transmission and distribution plants and facilities of the project. "The imminent operation of the Shasta power plant and the Shasta-Oroville transmission line, together with other scheduled power generation and distribution facilities, made it advisable to obtain the services of a specialist in the field of power utilization," Regional Director Charles E. Carey stated. Since 1939 Mr. Bixby has been associated with the Bonneville Power Administration, first as chief of distribution operations and, later, as chief of commercial operations.

•

A. R. Cumming Assigned New Personnel Duties

A. Raymond Cumming, formerly commercial cooking engineer, has been appointed personnel assistant to the general superintendent of production,

United Illuminating Co., New Haven and Bridgeport, Conn.

He will be responsible for maintaining the job classification record and for assisting in the preparation of new job memoranda, besides being available for consultation on personnel matters and active in the co-ordination of production employee training and educational programs.

R. B. Stuart, Jr., Heads Rhode Island League

Robert B. Stuart, Jr., sales manager Blackstone Valley Gas & Electric Co., Pawtucket, has been elected president of the Electrical League of Rhode Island, succeeding John E. Marshall. Aime Paulhus of the above utility, A. V. Bartlett, Rust Electric, Providence, and H. R. Tracy, Tracy & Co., Inc., Providence, have been named vice-presidents, J. G. Armstrong and H. E. Dawson, both of Narragansett Electric, Providence, being respectively treasurer and secretary-manager.

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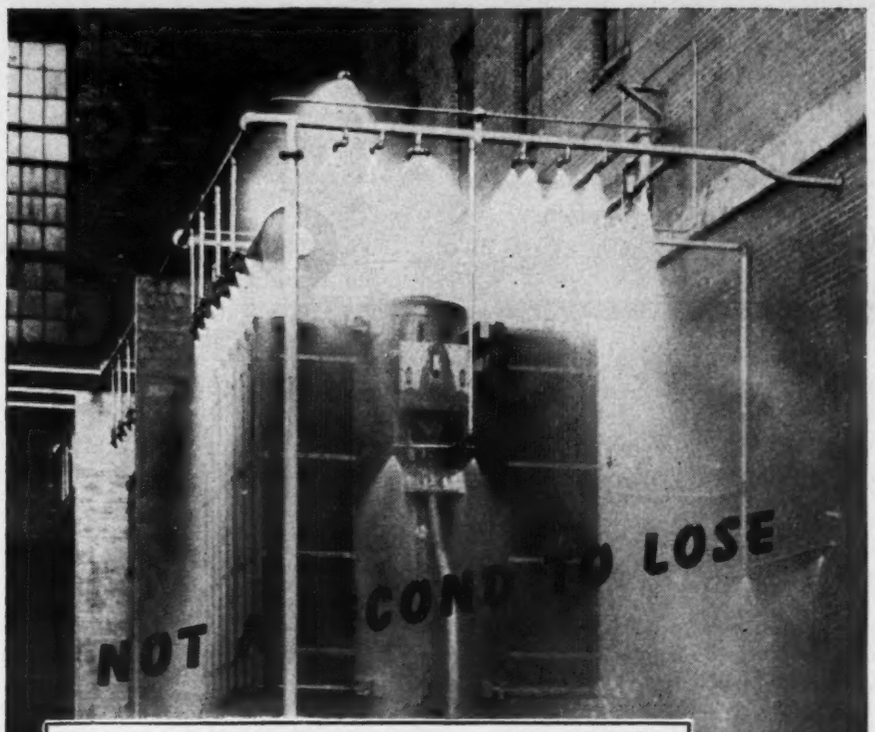
► W. C. MULLENDORE, executive vice-president of the Southern California Edison Co., has been elected president of the Los Angeles Chamber of Commerce for 1944. Mr. Mullendore has had a long career of leadership in Los Angeles civic activities. His interest in Chamber of Commerce activities is state and nation wide. He is a member and a former vice-president of the U. S. Chamber of Commerce and vice-president and a director of the California State Chamber of Commerce.

► WILLIAM R. NORTHLICH, of the Washington, D. C., office of Owens-Corning Fiberglas Corp., has been transferred to the company's general offices in Toledo, Ohio, as assistant to the general sales manager. Mr. Northlich has a wide background of experience in the building materials sales field, sales promotion, and advertising. Joining Owens-Corning in 1942, Mr. Northlich was a member of the general sales staff for four months. He was then transferred to the company's Washington office where he contacted various government agencies on production planning and allocation matters. He is succeeded in Washington by A. E. Kincaid, Jr., who formerly headed the company's shipbuilding division.

► RALPH H. LIGHTNER has resigned as industrial sales manager of the Keystone division of the West Penn Power Co., Ridgway, Pa., to take a position with the Titan Metal Manufacturing Co. at Bellefonte. L. R. COLE of Pittsburgh has been appointed to the newly created job of division sales manager of Keystone. Mr. Cole joined the West Penn staff in 1928 as a serviceman in the meter department. His later experience has been in sales engineering and promotion in the commercial customer and industrial customers' department in Pittsburgh. He is a member of the Illuminating Engineering Society and the Pennsylvania Electric Association. The purpose of the newly organized set-up in Keystone is to co-ordinate all sales



A transformer blaze must be stopped in a very few seconds — before spreading flames and explosions wreck the entire installation. That's why so many utilities protect oil-filled equipment with a . . .

GRINNELL MULSIFYRE SYSTEM

MULSIFYRE SYSTEMS operate on the principle of mulsifying blazing oil with a driving spray of water. The oil is turned into a liquid which is incapable of burning. A Mulsifyre System extinguishes fire in a few seconds and prevents reignition.

Complete separation of water and oil takes place in a few hours . . . leaves oil undamaged.

There is absolutely no conductivity along the discharge of a Mulsifyre projector when spray strikes conductors carrying high voltages.

Mulsifyre Systems are permanently installed . . . they operate automatically or manually.

Recommended by Underwriters' Laboratories for use in extinguishing fires in flammable oils immiscible with water, wherever such oil is a fire hazard . . . in transformers and other oil-filled electrical equipment.

INVESTIGATE this simple, sure oil fire protection. Write for Data Book by Underwriters' Laboratories.
Grinnell Company, Inc., Executive Offices, Providence 1, Rhode Island.
Branch offices in principal cities.

GRINNELL
MULSIFYRE SYSTEMS

promotion under one head. Mr. Cole will assume the industrial sales responsibilities formerly handled by Mr. Lightner and, in addition, will be responsible for co-ordinating and directing all other sales and sales promotion activities in Keystone.

▶ S. D. MAHAN has been appointed director of advertising and public relations of the manufacturing division, the Crosley Corp., Cincinnati. For the past 2½ years Mr. Mahan has served the U. S. Treasury Department as director of advertising and promotion for the War Bond program and as associate national field director in charge of all war bond and stamp sales through retailers and the newspaper boys of the nation. He has been asked by the war finance division of the Treasury Department to continue his association with the above activities in the capacity of a consultant. In his new connection with the Crosley Corp. Mr. Mahan returns to the electrical appliance field, where he spent more than eight years, first as merchandise advertising and promotion manager and, later, as general advertising manager of the Westinghouse Electric & Manufacturing Co.

▶ DAVID T. SHUTE, assistant to the manager of the Liberty Mutual Insurance Co., has been appointed a member of the sectional committee on the National Electrical Safety Code of the American Standards Association. The scope of the committee covers the necessary regulations to insure the safe installation, operation and maintenance of electric lines and electrical equipment. It includes the grounding of circuits and equipment and the maintenance of electrical supply and communication lines from the standpoint of casualty hazard.

▶ WILLIAM D. ENNIS will retire on March 1 as Humphreys professor of engineering economics at Stevens Institute of Technology, Hoboken, N. J., because of ill health. Dr. Ennis has been designated as professor emeritus from the date of his retirement. His approximate fifty years of engineering have been about equally divided between professional employment and private practice, on the one hand, and college teaching on the other. He served as technical adviser to the War Department Claims Board at Washington. Following this he was one of the founders of the Technical Advisory Corp. of New York, which carried on a variety of engineering work on a nation-wide scale. In 1929, upon the founding of the Humphreys professorship by Arthur G. Glasgow and others, Professor Ennis became its first incumbent. Dr. Humphreys has been Mr. Glasgow's partner in the international engineering firm of Humphreys & Glasgow, Ltd., of London. Dr. Ennis is the author of six

lege text books, besides many professional papers and articles in technical magazines, and has been a speaker in frequent demand on engineering economics topics before a variety of organizations. He has been associated with the American Society of Mechanical Engineers since 1898 and was elected a fellow of the society in 1939. He is also a fellow of the American Association for the Advancement of Science and of the Royal Economic Society and a member of the American Management Association and the Society for the Promotion of Engineering Education. His organization and development of a department of economics of engineering has been a major contribution to engineering education.

▶ JAMES N. MORRELL has been appointed sales manager of the Limitorque valve control division of the Philadelphia Gear Works, Philadelphia, Pa. THOMAS V. WITHINGTON has relinquished his position as chief engineer to become assistant sales manager, Limitorque division. WILLIAM F. PLUME has succeeded Mr. Withington as chief engineer and ROBERT E. RICHARDS has been appointed assistant chief engineer. All have been associated with the company for some time.

▶ B. J. BRUGGE has been appointed welding engineer in the Detroit, Mich., office of the Lincoln Electric Co., Cleveland, Ohio. Mr. Brugge, who has been associated with Lincoln since 1931, has served in the Los Angeles, Calif., and Houston, Tex., offices, and until his transfer to Detroit he has been located in Washington, D. C. Mr. Brugge began his career in arc welding with two years in Lincoln Research Laboratories. In 1935 he was granted a leave of absence to assist the application of electric welding in the Near East. Serving in the capacity of welding superintendent for the Anglo-Iranian Oil Co., he spent two years in Iran, supervising welding operations in the construction of refineries and pipe lines. Following his work in Persian oil fields, he spent four months in the British Isles as welding consulting engineer for British and Scottish firms. During the past two years Mr. Brugge has conducted some welding activities for the Army and has also assisted the Navy and Maritime Commission with consulting services on shipwelding.

▶ W. E. SLABAUGH, JR., has been appointed manager of the Westinghouse Electric appliance division's vacuum cleaner sales section. He joined Westinghouse in 1936 as commercial refrigeration supervisor for Ohio, Michigan, western Pennsylvania, West Virginia, Kentucky and part of Indiana. He was assigned to the war products engineer-

"We've had our Greenlee 5 years — it saves us 15% in man hours and cuts material spoilage 25%," says Lyle Foster, Foster Electric Co., Peoria, Ill. The above photo, taken in the Foster shop, shows how one man easily operates the powerful hydraulic bender, developing *40 tons pressure*, for bending up to 4½-inch pipe.

Whatever your bending job — all types of tubing, thin and heavy-wall conduit, copper or standard pipe — there's a Greenlee Bender to do it better and faster... with smooth, accurate, uniform bends. Greenlee Benders are light, compact, easily-carried. Get the facts now by writing for free Bender Booklet below.

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Used to accurately delay the closing or opening of an electric circuit following a power failure or disconnect of the A. C. operating potential. Or to provide an adjustable time delay between the closing of a pilot circuit and the subsequent closing or opening of the Timer load circuit. Ideal for automatic protection of electronic tube plate circuits against sudden application of power and to preclude overloads on branch motor circuits after power interruptions. Powered by self-starting industrial type synchronous motors, which are not affected by changes in ambient temperature or vibration.

Write for complete catalog of time control instruments today.

PARAGON ELECTRIC COMPANY
407 SOUTH DEARBORN STREET
CHICAGO 5, ILLINOIS

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ing department in 1942. During the remainder of the war Mr. Slabaugh will continue working in that branch of the war products engineering department which handles contracts for ailerons, elevator and other parts for fighter planes. After the war, he will direct development work, manufacture and distribution of vacuum cleaners for Westinghouse.

▶ JOHN F. LEBOR, assistant treasurer of the York Corp. since 1941, has been named treasurer. He joined the corporation in 1940 as assistant to the executive vice-president.

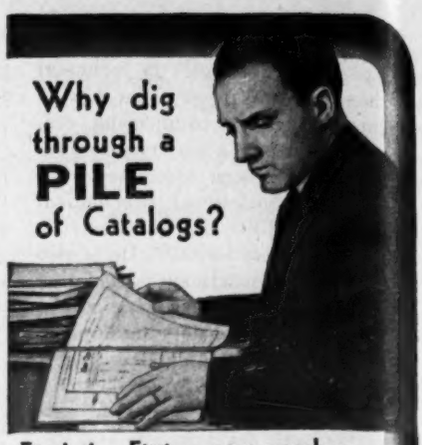
▶ WILLIAM I. BENDZ, specialist in electronics and control applications in the New England office of the Westinghouse company, has been appointed industrial consultant and applications engineering supervisor for the New England district. His headquarters will continue at Boston, Mass.

▶ DR. CHARLES A. GETZ, director of the research division of Cardox Corp., has been elected to fill the newly created position of vice-president in charge of research of that company. Dr. Getz is well known for his scientific work at the University of Illinois and at Cardox Corp. on carbon dioxide gas and its application to fire extinguishing.

▶ FRED FULLE, who has been associated with the lighting industry for almost 20 years, has been appointed product manager of cold cathode lighting in the lighting division of Sylvania Electric Products, Inc. Mr. Fulle is to couple a thorough study of all cold cathode products and applications for post-war use with activities in current work of Sylvania, which is heavily engaged in war production. Beginning in factory work with Claude Neon Lights, Inc., in 1926, Mr. Fulle rose to sales manager in 1928 and vice-president in 1938. In 1936 he went to Europe to survey advanced lighting in Paris and London, and after he returned he supervised sales, engineering and manufacture of installations at the New York World's Fair. For the past three years Mr. Fulle has been with the Federal Electric Co., first as manager of the New York and Philadelphia offices and later in Chicago as assistant manager of its lighting division.

OBITUARY

▶ LAWRENCE H. DUNHAM, assistant manager of metallurgical department of the American Steel & Wire Co., died suddenly in Pittsburgh, Pa., on January 19. Mr. Dunham began working for the American Steel & Wire Co. in 1916 as a laboratory assistant in the physical laboratory in Cleveland, the position he held until he was made laboratory di-



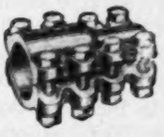
Find the Fitting you need—quickly—in the COMPLETE line

If you have a Penn-Union Catalog, you can instantly find practically every good type of conductor fitting. These few can only suggest the variety:

Universal Clamps to take a large range of conductor sizes; with 1, 2, 3, 4 or more bolts.

L-M Elbows, with compression units giving a dependable grip on both conductors. Also Straight Connectors and Tees with same contact units.

Bus Bar Clamps for installation without drilling bus. Single and multiple. Also bus supports — various types.


Clamp Type Straight Connectors and Reducers, Elbows, Tees, Terminals, Stud Connectors, etc.

Jack-Knife connectors for simple and easy disconnection of motor leads, etc. Spring action — self locking.

Vi-Tite Terminals for quick installation and easy taping. Also sleeve type terminals, screw type, shrink fit, etc. etc.

Splicing Sleeves, Figure 8 and Oval, seamless tubing—also split tinned sleeves. High conductivity copper; close dimensions.

Preferred by utilities, industrials, electrical manufacturers, contractors — because *they have found that "Penn-Union" on a fitting is their best guarantee of Dependability.*

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

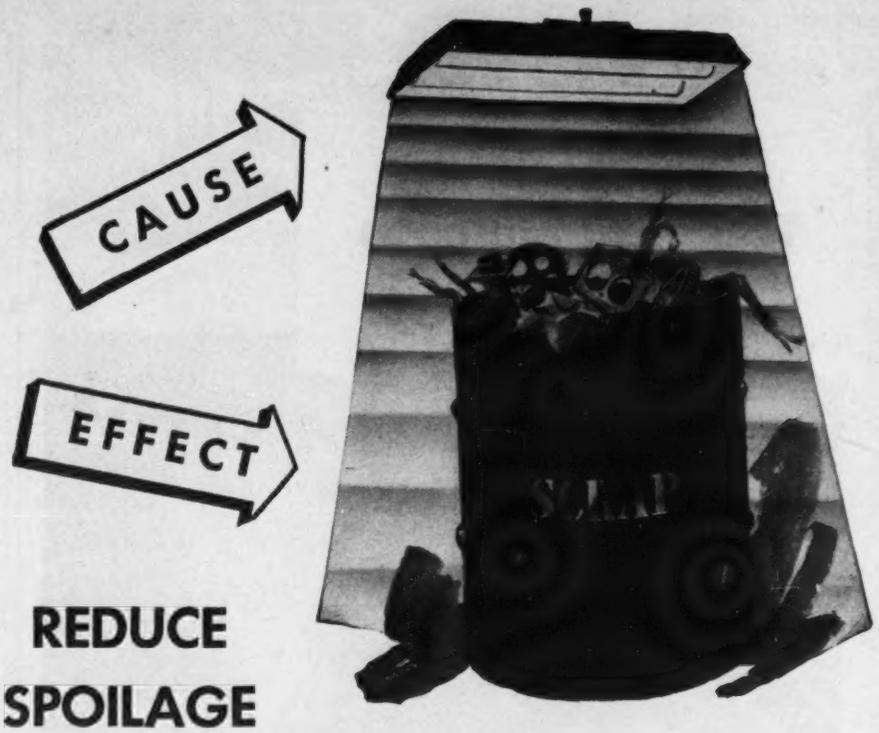
rector in 1919. Subsequently he served as assistant to the chief metallurgist in Cleveland, as a district metallurgist in the Chicago district, works metallurgist at the Waukegan (Ill.) Works and since 1942 as assistant manager of the metallurgical department. Mr. Dunham was born in Chicago in 1891 and he received his engineering education at the University of Illinois. He was a member of the American Society for Testing Materials, the American Welding Society and the American Iron and Steel Institute.

▶ALFRED A. ZIEGLER, 79, for many years a manufacturer of electrical signaling equipment, relays, and other products in Boston, Mass., died at Milton, Mass., January 17.

▶MAXWELL R. BERRY, founder and president-treasurer of the Electric Products Co., Cleveland, Ohio, died on January 24 in a Jacksonville, Fla., Hospital. Mr. Berry, who had resided in Cleveland for 32 years, left his home on January 12 for his winter residence at St. Simons Island, Ga. When he became ill he was moved to Jacksonville.

▶GEORGE W. MADISON, formerly merchandise manager of the Portland General Electric Co., Portland, Ore., died recently, at the age of 43. Mr. Madison was born in Grand Rapids, Mich. He joined Portland General Electric Co. in 1927 as an appliance salesman and was made supervisor of salesmen three years later. In 1936 he was promoted to the position of merchandise manager. He was identified with the sale of electrical merchandise as far back as 1917, when he entered the merchandise department of the Westinghouse Electric & Manufacturing Co. in Seattle. In 1922 he went to Portland as salesman for Stubbs Electric Co., where he remained until he joined the Portland utility. He had remained in Portland until two years ago.

▶WILLIAM F. JAMES, recently general manager of the South Philadelphia Works of the Westinghouse Electric & Manufacturing Co., died on December 12, in his sixty-fifth year. From 1936 to 1942 Mr. James was president of the Philadelphia Chamber of Commerce. He was a leader in industrial relations work and city and regional planning. He was among the early organizers of the Council of Defense and handled the first aluminum drive in Philadelphia. During an apprenticeship with the Quaker City Electric Co., Mr. James obtained his technical education by means of private study, which aided him in later becoming electrical designer and then superintendent of the Quaker City company. In 1909 he resigned his position to join the Philadelphia sales office of



REDUCE SPOILAGE with G-E *Watch Dog* STARTERS
REG. U.S. PAT. OFF.

Is spoilage in your plant becoming a problem? Then check the condition of your lighting system. Blinking and flickering of dying fluorescent lamps irritate war workers and impair the quality of their workmanship. Today that's serious! Eliminate annoying blink once and for all by switching to General Electric's new line of Watch Dog Fluorescent Starters.

THE WATCH DOG STOPS 'EM COLD

When a lamp reaches the end of its useful life, blinking and flickering start but the Watch Dog stops 'em cold. This manual reset starter cuts itself out of the circuit by eliminating all flow of current. Dead lamps are prevented from being started needlessly, current is saved, ballast is safeguarded and starter life is prolonged. All this adds up to less maintenance time when manpower is at a premium.

FS-100 for 100-watt lamps

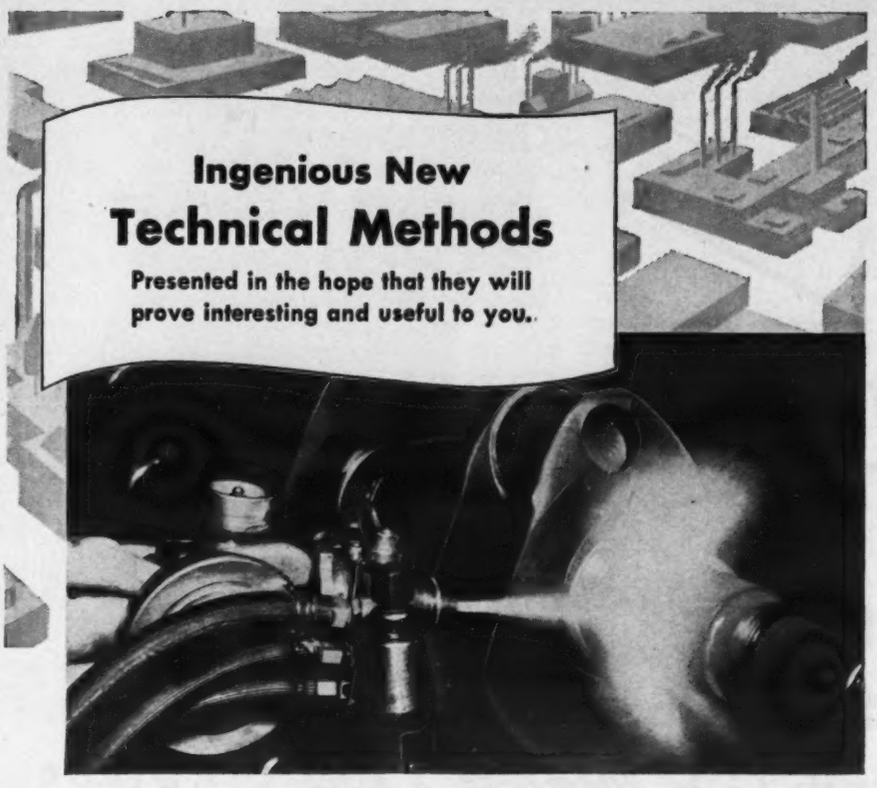
FS-40 for 40-watt lamps

SEND FOR FREE CATALOG

The G-E Fluorescent Accessories Catalog tells how to use fluorescent accessories for best lighting results. Send your request to Section G-242-9, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn.

BUY WAR BONDS ★

GENERAL ELECTRIC

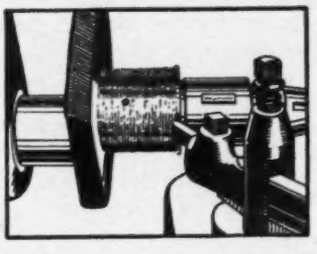


Ingenious New Technical Methods

Presented in the hope that they will prove interesting and useful to you.

New Metal Surfaces Made by Spraying

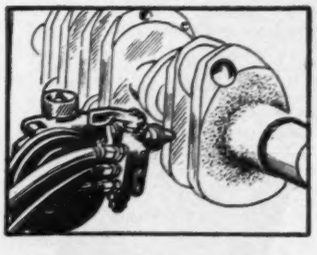
Molten metal is now sprayed or atomized on to metal surfaces for the purpose of salvaging worn bearings, shafts, cylinder walls and such parts. Metallizing, as the process is called, is also used for putting a non-corrosive coating on iron or steel surfaces subject to corrosion such as cylinder walls of internal combustion engines, valve gates and such parts in contact with water. The metals to be sprayed may be aluminum, zinc, stainless steel, high carbon steel or other alloys depending upon the character of the surface desired. The sprayed surface may be "over built" and machined down to size to obtain accurate surfaces.



Rough threading—cooling locks metal firmly to surface, producing a permanently tight bond.

Metal spraying guns have been perfected for use with various types of gases for heat, depending upon the melting temperature of the metal to be sprayed.

We hope this has proved interesting and useful to you, just as Wrigley's Spearmint Gum is proving useful to millions of people working everywhere for Victory.



Sprayed journal before finishing —Main bearing journal after surface has been Metallized.

You can get complete information from the Metallizing Company of America, 1330 W. Congress St., Chicago, Illinois.

Y-103

the Westinghouse Electric & Manufacturing Co. He was engaged in general industrial sales work for Westinghouse until 1912, when he began to specialize in steel mill electrification. He was made manager of the industrial division in 1923 and Philadelphia district manager in 1925. For many years Mr. James was active in the Philadelphia sections of the American Institute of Electrical Engineers and of the American Association of Iron and Steel Electrical Engineers, now the Association of Iron and Steel Engineers, and was a past-regional vice-president of A.I.E.E. He was also a past-president of the Electrical Association of Philadelphia.

▶ WALTER H. HALLSTEEN, vice-president and treasurer of the Ilg Electric Ventilating Co., Chicago, Ill., died on January 15 at St. Francis Hospital, Evanston. He was 53 years of age. A graduate of Armour Institute (now Illinois Institute of Technology), he joined the Ilg sales staff in 1916. He then was brought into the factory office and made an assistant on purchasing. Shortly thereafter he was promoted and placed in charge of the purchasing department, where he continued up to the time of his death. In the course of time additional responsibilities were given to him until he was appointed to the position of vice-president and treasurer. Mr. Hallsteen was well known in purchasing circles. For many years he was a member and was a past-president of the Chicago Purchasing Agents Association and had served as district vice-president of the National Association of Purchasing Agents.

▶ ERNEST L. BRANDT, managing secretary of the Detroit Engineering Society, died on December 14, in that city at the age of 60. Mr. Brandt was born in Toledo, Ohio, and received his technical education at the University of Michigan. Subsequently he was employed by the American Bridge Co. in Toledo and the Michigan Central R.R. at Detroit, becoming chief draftsman in 1909, and assistant office engineer in 1920. Following this professional activity, Mr. Brandt entered upon his long career in organization and technical society work when he was appointed assistant secretary of the American Association of Engineers, being located in both Chicago and St. Louis. Previously he had been quite active in the Michigan Engineering Society. In 1923 he was made managing secretary of the Detroit Engineering Society, continuing in that capacity until the society was terminated in 1936. Concurrently, the Engineering Society of Detroit was incorporated and Mr. Brandt was retained as managing secretary.

The absorbing history of the electrical industry and its enterprising founders

vividly presented in this readable and inspiring biography

JUST PUBLISHED!
The life-story of
ELIHU THOMSON

Not only the story of Elihu Thomson, pioneer and genius of the electrical age and his great personal contributions to the field of electricity in inventions and developments of electrical machines and appliances, here is a biography, embracing as well important, modern electrical developments, telling the story of history-making inventions and giving intimate views of the men who made them: Edison, Westinghouse, Steinmetz, Kelvin, Crooks, Marconi, and a host of others whom Elihu Thomson knew well.

BELOVED SCIENTIST

Elihu Thomson

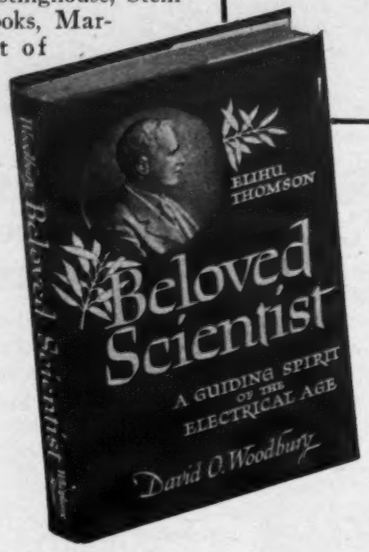
A Guiding Spirit of the Electrical Age

By DAVID O. WOODBURY

With a Foreword by OWEN D. YOUNG

Whittlesey House Publication

358 pages, 6 x 9, 20 illustrations, $3.50



Examine the book 10 days on approval

Elihu Thomson fits into the assemblage of electrical personalities as one of the most interesting and inspiring fo them all. His youthful precocity, his years of laboratory experiments in his own home, his life as a student and later as a teacher and professor, and finally his great career as an inventor make fascinating reading. To the credit of Elihu Thomson, chemist and electrical engineer, are nearly seven hundred patents, many of which are basic and in universal use today. More than that, he was a philosopher and one of the world's great teachers. For many years he was acting President of M.I.T. and on the Board of Trustees.

Here, vividly told, are many such absorbing developments in the electrical field as:

- the founding of General Electric
- the harnessing of electricity for lighting, trolleys and all the hundreds of appliances which today we take for granted
- establishing the first industrial laboratory
- discovering startling new methods for the use of the dynamo
- short-distance communication forerunning the telephone
- the pioneer use of tuned electric circuits on which radio has come to depend
- the chance discovery of electric welding
- making X-ray safe for widespread use
- perfecting arc and incandescent lighting

OWEN D. YOUNG says in the Foreword:

"Elihu Thomson would have been great in any field to which he chose to direct his talents. He was in fact great in many fields.

"It was the good fortune of the electrical industry that his early training and youthful experimentation accentuated his interest in the electrical field. It was fortunate, too, that circumstances, largely of his creation and not the result of accident, encouraged Elihu Thomson's pursuit of the unknown in this ever widening field. He found more problems to be solved at eighty than he dreamed of at twenty. His confidence had increased too—a confidence that man could always reduce the unknown to the known."

•

Appealing to Those in the Scientific Field

"A thorough, sympathetic biography of man, career and contributions in this story of Elihu Thomson . . . His work in new fields, his supremacy even over Edison in practical application and meticulousness of invention along electrical engineering lines brought him recognition in scientific circles. This is a study of quiet, fruitful labors of a kind, generous, simple man, which will appeal . . . to those in the scientific field."

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MANUFACTURING-MARKETS

Urges Government Assure Business

Stressing that business cannot make definite post-war plans until it knows "what the rules are going to be when the game starts," Lewis H. Brown, president of Johns-Manville Corp., in an address before the Sales Executives Club of New York, declared: "The first step after Germany is defeated is for the new administration and the new Congress to announce clearly that we are not going to continue a war economy after the war is over."

"Private enterprise must continue to go forward with confidence," he continued, "assured that government will proceed at once to remove every obstacle and to offer every reasonable inducement to the building of new productive equipment which will provide employment and eventually raise the standard of living."

Such assurance by the government, he asserted, will enable industry, labor, agriculture and government co-operatively to bring about a program that will encourage the expansion necessary to meet our post-war needs.

"In building such a program," he said, "we must profit from past experiences and guard against inconsistencies in economic policies which can allow taxes to fall too largely on venture capital and on incomes derived from daring and innovation, thus drying up a major source of employment; policies which encourage monopolistic practices that restrain free competition; policies which allow strong pressure groups to force wages or prices too high for full employment . . . In any event, they (the American people) will demand at the end of this emergency that freedom of enterprise be restored . . . The first requisite will be to provide reasonably full employment. Can private industry meet this challenge? I believe that private industry, encouraged by a government that does its part to create a climate favorable to the development of initiative, enterprise and expansion, can do the job."

ARMY-NAVY "E" CEREMONY—In recognition of their accomplishments in the production of war equipment, the Army and Navy conferred their "E" Award upon the men and women in the Mansfield (Ohio) plant of the Ohio Brass Co. recently. In a brief but colorful ceremony, addresses were made by Col. H. M. Reedall, chief of the Cleveland Ordnance District, War Department, and Lieut.-Commander A. E. Heiser, U.S.N.R., resident inspector of naval materials

Renegotiation Cuts Collyer Revenue

Collyer Insulated Wire Co., Pawtucket, R. I., reports revised net earings for 1942 as affected by renegotiation of Federal government contracts to be $4.50 per share on 150,000 shares outstanding, instead of $10.78 per share as previously made public. Since these renegotiations have only recently been completed, no accurate report can be given for 1943, but at the recent annual meeting R. C. Moeller, treasurer and newly elected president, estimated the net per share at about $2.66. Last year's sales before renegotiation totaled $17,898,000 gross.

W. H. Barney, general manager, reported that in 1943 the company produced 22,000,000 ft. of ship cable, 30,000,000 ft. of marine cable and 24,000 miles of army field wire. The plant operates 24 hours a day and employs 1,200. Postwar conversion is expected to be relatively simple, as the existing machinery will turn out peacetime products and a large demand is anticipated for wire for radio receiving sets.

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Manufacturers Make Sales Appointments

Manufacturing companies have recently announced the following assignments to their sales staffs:

Allen-Bradley Co. has appointed Rietze & Co., 1017 E. Broadway, Louisville 4, Kentucky, as sales representatives to handle the southern Indiana and western Kentucky territories.

The Crosley Corp. has appointed N. B. Dinkel of Alameda, Calif., to represent it in the Pacific Coast area. Mr. Dinkel first became associated with the major household appliance industry in 1927 and most of his experience in that field has been in San Francisco and other Pacific Coast cities.

Graybar Electric Co. has appointed John E. Fontaine manager at Beaumont, Tex., to succeed the late J. P. O'Neill. Mr. Fontaine has been connected with Graybar since 1928.

Edward Valve & Mfg. Co., Inc., has appointed Ehelman & Patter, Birmingham, Ala., and Charlotte, N. C., representatives for the southeastern United States. The territory includes The Carolinas, Georgia, Florida, Alabama and eastern Tennessee.

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Electric Controller Opens New Washington Office

Announcement has been made by the Electric Controller & Mfg. Co. of Cleveland, Ohio, of the opening of an office at 732 Barr Building, 910 Seventeenth Street, N. W., Washington, 6, D. C. A. W. Hartman will be in charge of the office.

ONLY AN ELECTRICAL WHOLESALER COULD THUS SPEED WAR PRODUCTION

Coat pocket "shipment" launched Navy boat

Rush Trip By Wesco Man For Electrical Pushbuttons Assured On-Time Christening.

The champagne bottle was be-ribboned and the compact Navy boat stood poised on the ways ready to slide into Massachusetts Bay. Suddenly it was discovered that pushbuttons, essential to the many electrical operations aboard the vessel, had never been ordered. After a thorough search of the vicinity verified that buttons of the right types and sizes were unobtainable, there was a confused halt in launching plans.

Arriving at the shipyard in answer to an urgent call, the Wesco man went into action; in a few minutes he was on a train speeding to New York. Early the next morning he was back in the yard, his coat pockets bulging with the pushbuttons —so little in size, so vital in importance. Thanks to Wesco's unconventional service the situation was saved and the launching took place as scheduled.

Wesco's uncanny ability to get things done in the face of obstacles and emergencies has speeded many a wartime job to early completion. Your present and postwar problems will be solved more easily if you employ the services Wesco can place at your disposal.

WESCO SPEEDS WAR PRODUCTION

* To start production, a powder plant required special floodlights. Best quoted delivery involved a paralyzing 14-week delay. Wesco contacted a manufacturer and delivered the "floods"—in only 10 days!
* A steel plant under construction required 18 items from 6 manufacturers. Wesco delivered the complete order in 3 days—averting a 9-month delay.

• • •

WESCO SERVES BUSINESS

* By providing trained sales and engineering personnel.
* By buying large quantities at low prices and passing the savings on to small-quantity buyers.
* By assembling all parts of an order in one shipment.

GIVE YOUR BLOOD TO THE RED CROSS

Westinghouse Electric Supply Co.

150 VARICK STREET . . NEW YORK (13), N. Y.

A NATIONAL DISTRIBUTING ORGANIZATION WITH 80 BRANCHES

Tune in John Charles Thomas, NBC, Sundays, 2:30 P. M., E. W. T.

How to Get Your Money's Worth in FREQUENCY METERS

Check These Points

Model 33-F, Full-cycle increment, shown indicating frequency of 60 cycles. Black dial for special war application.

Here are the facts on J-B-T VIBRATING REED FREQUENCY METERS

ACCURACY — Half-cycle increment, ±0.2%; full-cycle increment ±0.3%. This accuracy is not affected by normal *temperature* change, *wave form* or *external magnetic* fields.

COMPACTNESS — Made in several sizes, most popular of which is the standard 3½" panel mounting model, meeting C39.2-1943 ASA specifications for mounting and stud size of Electrical Indicating Instruments. No external reactor.

WEIGHT — Model 31-F, 3½ inch, 5 reeds, weighs only 0.54 lb; Model 33-F, 3½ inch, 11 reeds, 0.59 lb. Other models are correspondingly *light*.

VOLTAGE VARIATION — Will operate on voltages as low as 8 volts. Standard 110-115 volt models will operate satisfactorily over range of 100 to 150 volts. Also made for narrower voltage variation if desired. (Incidentally, current consumption is low. For Model 33-F, for example, ½ watt at 115V.)

RUGGEDNESS — No parts to wear out or get out of calibration. All are securely anchored to the base with lock washers at every critical point. The only movement is at the free end of the spring steel reed. J-B-T meters on portable field equipment have established an enviable performance record.

J-B-T Vibrating Reed Frequency Meters are available for frequencies from 15 cycles to 400 cycles with various reed groupings, increments and case sizes. For additional facts on the complete line, send for your copy of Bulletin VF-43.

J-B-T

(Manufactured under Triplett Patents and/or Patents Pending)

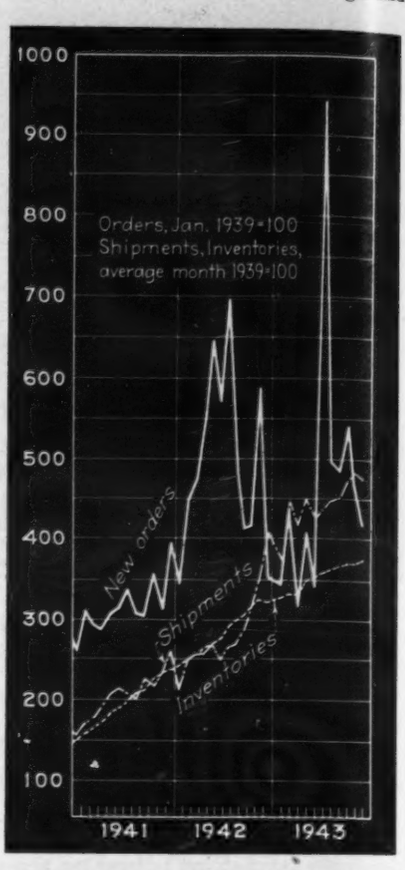
2-JBT-3

J-B-T INSTRUMENTS, INC.

439 CHAPEL STREET • NEW HAVEN 8, CONNECTICUT

Machinery Orders Drop in November

New orders received by manufacturers of electrical machinery decreased in the month of November, 1943, the index compiled by the Bureau of Foreign and



ELECTRICAL MACHINERY INDICES of Bureau of Foreign and Domestic Commerce

Domestic Commerce dropping to 417 from 472 in October.

The index covering electrical machinery shipments in November also lost ground, dropping to 476 from 484 in October.

Electrical machinery inventories advanced in November, the bureau's index rising to 374.9 from 368.2 the preceding month.

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"E" Awards Announced

Among the recent recipients of the Army-Navy "E" award are the following: Aluminum Co. of America, Trentwood, Wash.; Square D Co., Milwaukee, Wis.; Edwards & Co., Norwalk, Conn.; Columbia Electric & Manufacturing Co., Spokane; De Laval Steam Turbine Co., Trenton, N. J., third "E" star; Philco Corporation, Simplex radio division, Sandusky, Ohio, second white star; Babcock & Wilcox Co., Augusta (Ga.) Works of the Refractories Division, second renewal.

Field Reports on Business

Recent reports indicate that even higher levels of output of war materials than have already been reached must be attained to sustain the military effort lying ahead. Heavy industries are still sending in favorable reports. Retail trade throughout the country continues at a brisk pace.

NEW YORK

Despite the rapid rise of industry in the South and West, boosted by war production, the New York region "still holds its own as king of consumer markets," according to Carl H. Henrikson, regional business consultant of the United States Department of Commerce, last week in his fourth quarterly report for 1943. Mr. Henrikson added that "the region stands to benefit more than others from an anticipated large increase in foreign trade after the war."

Department store volume here was estimated as averaging about 8 percent ahead of the like week in 1943, while the Federal Reserve Board reported that sales last week were 14 percent higher than during the corresponding week a year ago throughout the country. The index of business activity in the Pittsburgh district, after seasonal adjustment, reached the level of 175.3 percent of the 1935–39 level in the week ended January 22, according to the Bureau of Business Research, University of Pittsburgh.

Civil engineering construction volume in continental U. S., according to the *Engineering News-Record*, totaled $33,241,000 for the week. This volume is 30 percent higher than in the preceding week, but is 20 percent under the volume reported for the corresponding 1943 week. The current week's construction brings 1944 volume to $179,018,000 for the four-week period, a decrease of 21 percent from the $226,826,000 for the period in 1943.

NEW ENGLAND

About $3,000,000 in public works is planned for Worcester, Mass., in 1944, including $778,500 for a new public library, $412,500 for the city hospital, and many school, police, water and fire department improvements. A new switchboard costing $15,500 for the Auditorium stage is also planned. The United States Rubber's $25,000,000 outlay for improvements and additions includes changes and expansion of facilities at its Chicopee, Mass., plant. Avon (Mass.) Sole Co. has been awarded a D.F.C. contract amounting to $150,000 to be used for additional plant equipment.

Watertown (Conn.) Mfg. Co. plans to install additional radio frequency heating equipment this year for processing plastic preforms following an initial 3-kw., 15-megacycle Megatherm (Federal Telegraph) application in this factory. A similar set for March delivery has been purchased by another Connecticut manufacturer of molded plastics. L. M. Duryee, industrial power engineer, Connecticut Light & Power Co., Waterbury, Conn., anticipates a fertile field for such applications in the months after victory. Collins Electric Co., Springfield, Mass., will install electrical equipment for a hospital at Chicopee Falls, Mass. Rutland (Vt.) Electric Products Co., a subsidiary of Connecticut Telephone & Electric Co., Meriden, plans improvements in its establishment. Contracts in the Rhode Island area recently awarded by the Navy include facilities at a training center, costing $256,000, to A. E. Stephens, Springfield, Mass., and installation of a fire protection system to Tredennick-Billings Co., Boston, for $47,250.

A sharp upward turn in loans for the purchase of previously built houses and for repairs of these is reported from real estate bureaus in this district. Federal savings and load associations are lending about $3,000,000 a month, or more than 50 percent over a year ago, and present home financing is running 50 percent higher than a year ago, with boom proportions looming when labor shortages are stemmed and restrictions on much-needed domestic electrical supplies are withdrawn.

PACIFIC COAST

Pacific Coast shipyards are working on contracts aggregating about 500 ships; $172,000,000 worth of naval facilities along the Coast was recently approved, the principal item being $92,000,000 for ordnance plants and depot; $5,000,000 for shore radio installations was also included.

Other new government construction, which has been considerably stepped up, includes additional shops for a naval air station in Washington, three warehouses for an embarkation port, $2,000,000 of depots for Army Air Force in Los Angeles county and Navy warehouses at Barstow, Calif.

Critical metals and ores increased California's 1943 mineral production 2½ percent over 1942, despite marked decreases in cement and gold.

Orders and prospective orders include city of Los Angeles award to Allis-Chalmers of $252,718 for six 16,667-kva. transformers, floodlights for greatly expanded sub-port of embarkation in California, low bids of $80,736 and $81,472, respectively, for lighting of Arizona and California army air fields, and a generally increased expenditure for lighting the larger fields, both service and CAA, now being constructed.

CHICAGO

Consensus in business circles here is that little resumption of civilian goods production can be expected until success in the contemplated invasion of Europe is assured. Although certain raw material surpluses exist there is little expectation here that government agencies will permit those manufacturing facilities which could be diverted from war production to become "frozen" in civilian production at this early date.

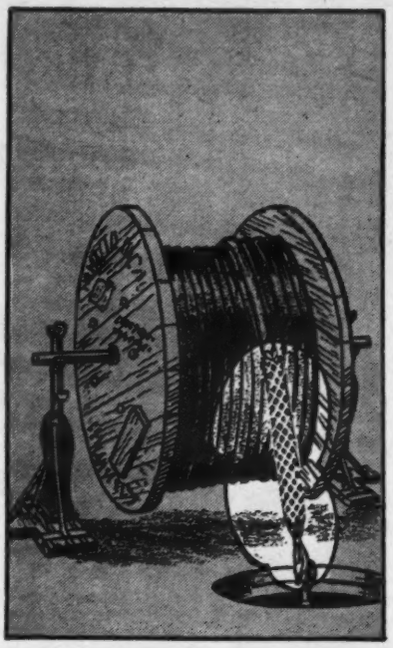
Occasional utility construction projects are being announced and more are expected in future months in the light of the WPB's known position favoring rehabilitation in 1944 of utility plant where necessary maintenance has been long deferred. Extension by WPB of the limits on expenditures for overhead line extensions from $500 to $1,500 may have some effect on the sale of distribution equipment, observers believe.

Wisconsin Electric Power Co., Milwaukee, reports that work will start soon on the steel frame superstructure for a new outdoor substation in the Granville district. For the Navy Department, Republic Flow Meters Co. has recently booked an order for $3,780 covering pressure regulators and valves.

Total department store sales in Chicago for the week ended January 22 were up 15 per cent over a year ago. During the week ended January 20, 1944, thirty-two Chicago area concerns received 42 war orders.

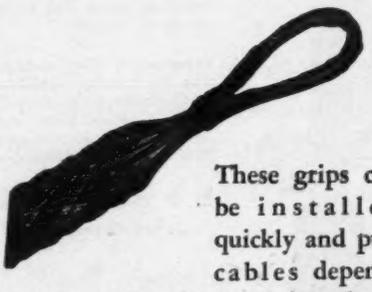
SPEED

CONSTRUCTION and EXPANSION of PLANT FACILITIES



RELIABLE CABLE GRIPS

For Pulling in Wires and Cable



These grips can be installed quickly and pull cables dependably. They do not let go halfway through a duct because the wires pull with evenly distributed load. Eight different styles—all supplied in a full range of sizes.

Reliable ELECTRIC COMPANY
OVER 35 YEARS SERVICE TO THE UTILITIES

"Bond-Rod" Ground Clamp Strong one-piece construction. Cup point screw.

Wedge Grip Connectors, with V corrugations that grip wires securely.

• Strong
• Efficient
• Practical
• Economical

Sherman

Solderless Fittings

Split Bolt Connectors. Deep cut threads withstand heavy wrench torque. Extra long pilot. With or without nut retainer.

Maintenance engineers, faced with material and manpower shortages, are finding these Sherman Solderless Fittings the perfect answer to many problems. These fittings make quick strong, permanent connections. They require no special tools — can be installed by less experienced men.

And — equally important today, these fittings can be salvaged and re-used time and again, thereby reducing costs and saving precious copper.

Investigate the possibilities for the increased use of Sherman Solderless Fittings in your own work. Let us send you full specifications and prices now.

H. B. Sherman Mfg. Co.
Battle Creek, Mich.

•

Write—for catalog showing the complete line of Sherman Electrical Specialties with engineering data and prices on each

Type SM Solderless Lug. Inexpensive one-piece construction. Compact, simple, rigid. May be soldered.

Type SO Solderless Lug. For heavy duty service. Serrated gripping surfaces hold conductor securely.

Sales Opportunities

MARYLAND—Eastern Shore Public Service Co., Salisbury, has authorized fund of about $1,725,000 for expansion and improvements in power plant and system, program to be carried out as soon as equipment and materials are available. Work will include addition to steam-electric station, with installation of new 17,500-kw. turbine-generator and accessories, high-pressure boiler and auxiliary equipment. Also extensions and improvements in transmission lines and distribution system; power substation will be enlarged, with installation of new automatic high-tension switchgear and miscellaneous equipment. Other power substations at different points in system similarly will be extended and improved.

MASSACHUSETTS—American Bosch Corp., 3664 Main St., Springfield, manufacturer of aviation and automotive electrical apparatus, will carry out expansion in branch plant, for production for government, including new buildings, with machinery and electrical equipment. Cost estimated about $1,350,000, with financing by Defense Plant Corp. Work will be placed under way soon.

CALIFORNIA—Navy Department, Washington, D. C., has authorized plans for new naval ordnance depot on 3,500-acre tract of land, with 4,000 ft. of water frontage. Work will include shops, warehouses and other industrial structures, with mechanical and electrical equipment. Also barracks, administration building and other operating buildings. A main power substation is planned, with electrical distribution system, service connections and other operating facilities. Cost estimated about $15,000,000. Graham, Anderson, Probst & White, Security Bldg., Long Beach, and 80 East Jackson Blvd., Chicago, Ill., are architects; Leeds, Hill, Barnard & Jewett, 601 West Fifth St., Los Angeles, are engineers. Project will be supervised by officer in charge of construction, Roosevelt Base, Terminal Island, Los Angeles.

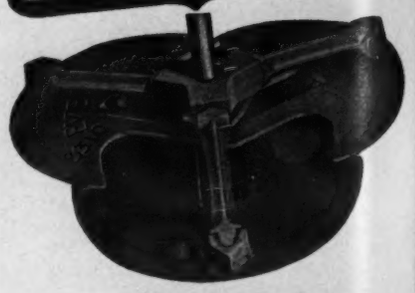
MINNESOTA—Electric Light Department, Jackson, plans extensions and improvements in municipal power plant as a post-war project, including installation of new turbine-generator and accessories, boiler, pumps and auxiliary equipment. Cost estimated about $200,000. Proposed to hold special election soon to approve bond issue in that amount. Jesse B. Harris Co., Essex Bldg., Minneapolis, is consulting engineer.

TEXAS—Water department, Big Spring, plans installation of motor-driven pumping machinery, controls and auxiliary equipment in connection with extensions in municipal waterworks plant and system. Cost estimated about $959,500. It is understood that application will be made for a priority rating. Freese & Nichols, Capps Bldg., Fort Worth, are consulting engineers.

WASHINGTON—Inland Empire Rural Electrification Administration, 325 East Sprague St., Spokane, V. P. Campbell, manager, plans early call for bids for primary and secondary lines, with line transformers, service connections and other operating facilities. Work will comprise about 30 percent of total of 270 miles of lines, construction of which was begun in 1942 and discontinued when approximately 70 percent completed by order of WPB, which has now granted priority rating for completion.

OREGON—Willamette Valley Wood Distillation Co., Eugene, care of Charles Snell-

EVERSTICK ANCHORS...



FOR SPEED IN INSTALLATION

The exclusive Everstick nut housing locks the Anchor firmly on the rod. This speeds up installation. Plates are so designed, that they expand easily into undisturbed earth, and extra holding power is achieved. Made of tough, rust-resistant malleable iron. Write for bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

ALL the strength and durability inherent in steel are combined—with definite economies—in *Crapo* Galvanized Steel Strand. Heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvaning Process, provide lasting protection against corrosion.

Ask the distributor of *Crapo* Galvanized Products near you or write direct for further information!

INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA

MAKES TURN-CUFFS THE LINEMAN'S FAVORITE

Cuffs turned up form a petticoat insulator effect . . . turned down, cuffs give a 2" longer protective gauntlet. Combine these features with the greater snag resistance and hand designed styling for comfort, and you see why linemen everywhere prefer SURETY TURN-CUFF GLOVES.

SLOT - TO - CENTER BLANKETS

Useful and practical. For primary or secondary line applications — covering spool and secondary wires, switches, transformers, dead ends.

NON - BINDING SLEEVES

"Top protection, real comfort," say users. Extra shoulder coverage — no bulk in front — adjustable. Cost no more than usual types. Write for complete data today.

THE Surety RUBBER COMPANY
CARROLLTON, O.

strom, head, Snellstrom Lumber Co., Crow Stage Rd., Eugene, is concluding arrangements with government for construction and operation of new plant for production of industrial alcohol from waste timber and sawdust. It will comprise several large one and multi-story units, with machinery and electrical equipment for large capacity. Also power substation, boiler plant, pumping station and miscellaneous structures. Cost estimated about $3,600,000. It is understood that financing will be provided by Defense Plant Corp.

ARKANSAS—Arkansas Power & Light Co., Pine Bluff, plans new 110-kv. transmission line. Cost estimated about $660,000. Application has been made for permission.

CALIFORNIA—Bureau of Yards and Docks, Navy Department, Washington, D. C., will have plans prepared at once for group of four one-story warehouses and industrial buildings, each about 200 x 600 ft., at naval depot, with mechanical and electrical equipment and facilities. No estimate of cost announced. Bids will be asked soon by Public Works Office, 11th Naval District, San Diego, which will supervise project. Holmes & Narver, 639 South Spring St., Los Angeles, are consulting engineers.

MINNESOTA—Board of Regents, University of Minnesota, Minneapolis, has authorized plans for new mechanical aeronautic engineering building at institution, to be carried out as a post-war project. It will be four-story and basement, about 200 x 374 ft., estimated to cost $1,175,000, with mechanical and electrical equipment. C. H. Johnston, Empire Bank Bldg., St. Paul, is architect and engineer.

FLORIDA—Navy Department, Washington, D. C., has authorized extensions in power supply and electrical distribution system at naval air station, including power substation equipment and other operating facilities. Cost estimated about $150,000. Also approved plans for submarine training center extensions at another point, including several buildings and other structures, with mechanical and electrical equipment. Cost estimated $604,200. Bureau of Yards and Docks, Navy Department, Washington, D. C., in charge.

CALIFORNIA—Department of Water and Power, 207 South Broadway, Los Angeles, has been authorized by City Council to prepare plans for proposed Owens River Gorge municipal hydroelectric power development, to be carried out as a post-war project. Work will include power dam, generating station with initial capacity of 95.000-hp., transmission lines for connection with present high-tension system of city, switching stations and other operating facilities. Entire development is estimated to cost $23,000,000. A. H. Van Norman is general manager and chief engineer of department.

ALABAMA—War Department, Washington, D. C., has authorized expansion and improvements in airport, including installation of permanent lighting facilities, with underground lines, controls, lighting units, signaling system, etc. Entire project will cost about $500,000 and will be supervised by U. S. District Engineer Office, Mobile.

IDAHO—Bureau of Reclamation, Denver, Colo., has secured a priority rating for work on irrigation project, to include a new pumping station on Spokane River, with motor-driven pumping machinery, controls and auxiliary equipment. Also power substation, with transmission line from connection with an existing high-tension line, about 2½ mi. distant, for power supply for pumping plant. Entire project is estimated to cost about $300,000.

IF MEDALS WERE GIVEN FOR LONG, FAITHFUL SERVICE-

For more than two decades Clark Electric Water Heaters, forgotten in dark basements, have silently and efficiently supplied the hot water needs of their owners. Yes, if medals were given for long, faithful service Clark Heaters would have them.

The same time-tested "black-heat" principle that has made their long, trouble-free service possible is still used in the Clark Electric Water Heater of today.

McGRAW ELECTRIC COMPANY
CLARK WATER HEATER DIVISION
5201 W. 65TH ST. CHICAGO
A TOASTMASTER Product

CLARK
ELECTRIC WATER HEATERS

A Live Wire is no better than its Connections

K & H
Hot Line Clamps

Catalog Nos. 4545C and 4565A

For Copper and Aluminum Lines

Made in Two Parts

Line Unit—The part that connects permanently to the line.

Connector Unit—The part to which tap wire is attached.

These clamps are designed to overcome three objectionable features encountered in making hot line connections in the past, viz.:

1—To eliminate arcing or crushing of line while connecting or disconnecting tap wire.

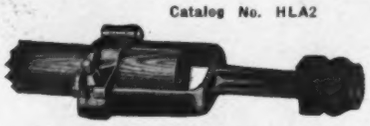
2—To prevent atmospheric corrosion rendering threads useless.

3—To forestall mechanical failure caused by ice and sleet.

HOT LINE STICK ADAPTER

Quickly and easily attached to any Hot Line Stick

Catalog No. HLA2



★ **WRITE FOR BULLETIN 11-A** ★

K & H KRUEGER & HUDEPOHL

S. E. VINE AT THIRD • CINCINNATI, O.

COHARDITE
INSULATED TOOLS

Reduce Accidents and Service Interruptions

#155 SCREW DRIVER

List Price $1.10

A long, thin, well-insulated screw driver. Ideal for reaching deeply recessed screws. Made with Stanley 100 plus quality blade to U. S. Navy specifications. COHARDITE insulated all the way down the blade to within ⅜" of the point.

Every tool tested to its full rated dielectric strength of 10,000 volts for one minute RMS before it leaves our plant.

A full range of COHARDITE insulated small tools carried in stock for meter and distributor departments.

Send for catalog.

THE CONNECTICUT HARD RUBBER CO.

442 East Street, New Haven, Conn.

REA Announces New Allotments

Announcement was made recently by the Department of Agriculture of loans to 21 Rural Electrification Administration co-operatives in ten states. The loans which total $3,327,150 were made chiefly for farm connections. Loans to three Ohio systems were made for the purpose of acquiring existing properties which will enable the co-operatives to reach 2,500 additional farms when construction materials again become available. All loans were made under WPB authorization or regulation.

This brings REA allotments to date to $477,645,241, of which $11,531,328 represents operations during the current fiscal year.

Included are the following:

COLORADO—Union Rural Electric Assn., Inc., Brighton, $15,000; San Isabel Electric Assn., Inc., Pueblo, $15,000; Highline Electric Assn., Holyoke, $60,000.

ILLINOIS—Wayne-White Counties Electric Co-operative, Fairfield, $50,000; Spoon River Electric Co-operative, Inc., Canton, $60,000.

IOWA—Grundy County Rural Electric Co-operative, Grundy Center, $70,000; Clarke Electric Co-operative, Inc., Osceola, $100,000.

KANSAS—Flint Hill Rural Electric Co-op. Assn., Inc., Council Grove, $50,000.

MINNESOTA—P.I.C.K. Co-operative Electric Assn., Braham, $75,000; Agra-Lite Co-operative, Benson, $13,000.

NEBRASKA—Butler County Rural Public Power District, David City, $4,150.

OHIO—Inter-County Rural Electric Co-operative, Inc., Hillsboro, $527,000; Union Rural Electric Co-operative, Inc., Marysville, $306,000; South Central Rural Electric Co-operative, Inc., Lancaster, $1,717,000.

SOUTH CAROLINA—Marion Electric Co-operative, Inc., Marion, $15,000; Marlboro Electric Co-operative, Inc., Bennettsville, $15,000.

TEXAS—Upshur Rural Electric Co-op Corp., Gilmer, $50,000; Wharton County Electric Co-op., Inc., El Campo, $25,000; Fort Belknap Electric Co-operative, Inc., Olney, $35,000; Taylor Electric Co-operative, Inc., Merkel, $75,000.

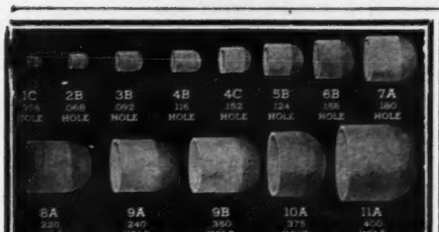
WISCONSIN—Richland Co-operative Electric Assn., Richland Center, $50,000.

NEW MODEL • HIGHEST ACCURACY CHRONOMETRIC TACHOMETER

Readability to 1 RPM per division. Guaranteed accuracy well within ½ of 1%. Indicates RPM directly on the dial without any calculations over a fixed period of 6 seconds. Negligible torque. Two models with ranges 0-1000 RPM or 0-10,000 RPM, each suitable for double rated range.

Write for bulletin No. 715.

HERMAN H. STICHT CO., INC.
27 PARK PLACE NEW YORK, N. Y.



STAR INSULATING BEADS

Use LAVOLAIN ball and socket beads for insulating bare wire. Heat resistant. High di-electric and mechanical strength. Made in U.S.A. Quality beads at low cost. Quickly applied. Flexible. Beads shown above are approximately half actual size. Ask for price list and samples.

STAR PORCELAIN CO.
51 Muirhead Ave. Trenton, N. J.

G.C.A.
Lamp Replacers
Lamp Base Removers
Cartridge Fuse Tongs
Switch Hooks

Send for Catalogue

We have been making safety tools for 27 years

THE G. C. A. Manufacturing Co.
Pittsfield, Mass.

Relay Test Switches
Push-Pull Type

Send for Cat. #5, Sec. I

Type RTS Switches are compact, positive.

THE STATES COMPANY

3 New Park Ave. Hartford, Conn.

Kelvinator Issues Post-War Guide

Although Nash-Kelvinator's factories are still completely occupied with war production, and will continue to be so indefinitely, the Kelvinator Division of the corporation has recently prepared and is currently distributing to Kelvinator appliance retailers a comprehensive post-war planning guide to aid them in making their basic preparations for post-war merchandising.

"This post-war planning guide is primarily a 'thought starter' and organizing tool containing ideas and suggestions which we believe will be helpful to appliance retailers, irrespective of any actual date when they may have new merchandise to sell," said Charles T. Lawson, general sales manager.

The guide itself consists of a "plan book" containing practical and helpful basic information and planning suggestions under the following headings: The market; the appliances to sell; the store or department; the selling organization; the promotion and advertising; creative selling, and replacement business. Concrete questions are listed under each of these subjects to guide the appliance retailer's thinking in taking steps now to include all of these factors in both his short and long term post-war plans.

•

Wage Increase Refused

The National War Labor Board has refused an appeal from an order by the First Regional War Labor Board at Boston in which an increase of 5 cents per hour for employees of the Anaconda Wire & Cable Co., Pawtucket, was refused. Both the company and the International Brotherhood of Electrical Workers (AFL) had asked the rate increase. The appeal was taken by IBEW.

Labor members of the National board dissented from the ruling that no further increase was allowable under the Little Steel formula.

PREMAX

Renew Marking with Metal

The Premax Way costs less than stenciling . . . and outlasts the pole.

Premax Products

Division Chisholm-Ryder Co., Inc.

4418 Highland Ave., Niagara Falls, N. Y.

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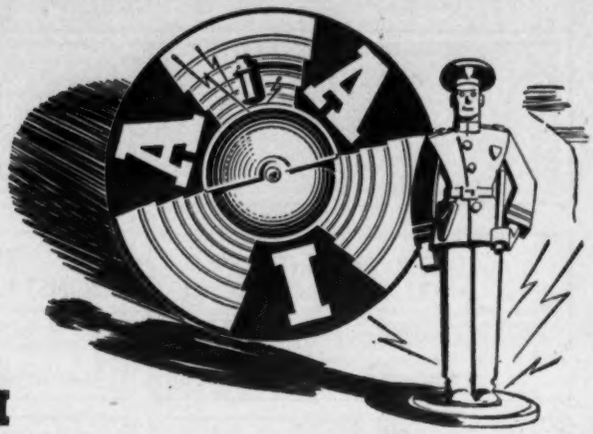
YOUR GUARD PROBLEM ANSWERED "AUTOMATICALLY"



MULTIPLYING efficiency many times while reducing to a minimum the necessity for human guards, A.A.I. Automatic Alarm systems are today protecting American industries, large and small, from the constant threat of sabotage, espionage and theft. Employing tiny robot sentries, or detectors, electronically operated, Automatic Alarms, on duty 24 hours a day, detect and report danger and dispatch guards to the actual zone of disturbance. *Simple to install, easy to maintain and relatively low in cost,* Automatic Alarms will serve you efficiently and economically. Consider this modern miracle of protection for your properties and plants.

Write for Literature

Licensed under DuPont and Assatic Patents

SALES OFFICES: Philadelphia, Chicago Detroit, and Toronto Canada

AUTOMATIC ALARMS Incorporated

848 MARKET STREET YOUNGSTOWN, OHIO, U. S. A.

For Real Safety in Handling Cable Reels!

Simplex No. 322. Capacity 10 tons; for reels 36" to 84" in diameter. Double acting automatic lowering — speedy lifting and lowering. The adjustable "T" base provides firm non-rocking foundation. Best for field work.

Cable Reel Jacks pay out cable safely, with worthwhile savings in time and manpower.

Also a screw type with "T" base for field work and other automatic lowering types for warehouse use.

Templeton, Kenly & Co. Chicago (44), Ill.

Better, Safer Jacks Since 1899

Simplex LEVER · SCREW · HYDRAULIC Jacks

Pull Overhead and Underground Cables the Easy Way! No. 324 Simplex Cable and Wire Tensioning Jack.

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Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

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ROBERT E. FOLEY CONSTRUCTION CORPORATION

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BLACK & VEATCH

Consulting Engineers

Water, Steam and Electric Power Investigations, Design, Supervision of Construction, Valuation, Tests and Laboratory Service.

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RESEARCH LABORATORY
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(A Chicago Suburb)

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ENGINEERS

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Chicago, Ill.

Ebasco Services Incorporated

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Two Rector Street New York

HOOSIER ENGINEERING COMPANY

Erecting Engineers
Transmission Lines, Substations

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327 South LaSalle Street, Chicago, Ill.
136 Liberty St., New York

STONE & WEBSTER ENGINEERING CORPORATION

Design and Construction
Report • Examinations • Appraisals
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BOSTON • NEW YORK • CHICAGO • HOUSTON
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Electrical Testing Laboratories Inc.

WAR WORK TESTS

ELECTRICAL — MECHANICAL — PHYSICAL — CHEMICAL — for compliance with Government Specifications.

Inspection—Analysis—Research—Certification

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WILLIAM S. LEFFLER

succeeding
CHARLES F. LACOMBE—WILLIAM S. LEFFLER
Engineers—Economists
RATE RESEARCH — SALES RESEARCH
FOR
POST-WAR PLANNING
Cost Analysis Rate Cases
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Engineers — Constructors

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Expert advice on location and purchase of right of way.
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Electric, Steam and Hydraulic Projects. Investigations, Reports, Designs and Appraisals.

WELSBACH ENGINEERING AND MANAGEMENT CORPORATION

Engineering - Electrical Construction - Management - Electric and Gas Street Lighting Maintenance

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10 CENTS A WORD, MINIMUM CHARGE $2.00. *Positions Wanted* (full or part time salaried employment only) ½ the above rates payable in advance.

Box Numbers—Care of publication New York, Chicago or San Francisco offices count as 10 words.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Individual Spaces with border rules for prominent display of advertisements.

The advertising rate is $7.25 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

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Radio Engineer for installation, maintenance and servicing essential electronic equipment in United States and abroad. Electrical background and *practical* radio experience required. Age 28-40. Salary $3600 up plus living expenses. Wire or write Radio Division, 2519 Wilkens Avenue, Baltimore 23, Maryland for application forms.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.

EXECUTIVES AND TECHNICAL MEN

Be ready for post war opportunities!

We solicit inquiries from qualified candidates who desire to contact employers for positions paying up to $20,000 per year. Confidential. Est. 20 years.

(Inquiries from Employers entail no obligation)

THE NATIONAL BUSINESS BOURSE
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LECTRICAL ENGINEER — Opening with steel company for position of senior electrical gineer. Submit full details of experience, aracter, and availability. P-632, Electrical orld, 330 W. 42nd St., New York 18, N. Y.

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LARIED POSITIONS — This advertising ervice of 24 years' recognized standing gotiates for high salaried supervisory techal and executive positions. Procedure will individualized to your personal requirements d will not conflict with Manpower Commisn's. Retaining fee protected by refund proion. Identity covered and present position otected. Send for details. R. W. Bixby, Inc., 2 Delward Bldg., Buffalo, N. Y.

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AN with long and valuable executive, estimating, engineering, and job management perience in electrical contracting desires reponsible connection. Available about Februy 1st. PW-638, Electrical World, 330 W. d St., New York 18, N. Y.

POSITIONS WANTED

OPERATING SUPERVISOR — Age 41, broad utility experience. Successful record achieving practical results by maintaining coordinated organization and harmonious employee relations. Engineering background with well rounded experience in generation, transmission, distribution, sales rates, accounting, administration, public relations. Interested in general supervisory position as superintendent, manager or executive assistant. Prefer position offering opportunities for improved operations. PW-630, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL ENGINEER — Superintendent, twenty years experience in electric production, transmission and distribution operation, maintenance and construction with Utility and Industrial Plants. Technical graduate. Employed, but available on reasonable notice. Desire connection with Utility or Industrial plant in West or South West. PW-643, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL OPERATING ENGINEER, age 38, degree BEE, 20 years experience in meters, substation maintenance and construction and control work. PW-644, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

GENERAL ELECTRICIAN with good technical training, age 45, in good health. Has been in charge of Maintaining all relays and other Maintenance in automatic Sub-stations in large Mid-western city. At present has charge of all Electrical equipment in modern steam plant. Desires position where ability can be used to fullest capacity. PW-646, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

(Additional Employment Advertising on the following page)

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To Electrical Manufacturers

Western Canada is an excellent market for a wide assortment of electrical products.

A thoroughly experienced sales organization with 25 years experience within the electrical industry offers you its services in promoting and developing a steady and active demand for worthy products.

Territory covered from Head of the Great Lakes to Pacific Coast inclusive. Highest references.

RA-640, Electrical World, 520 North Michigan Ave., Chicago 11, Ill.

Bringing you—up-to-the-minute information on TELEPHONY

Get the groundwork you need in telephone fundamentals for best results in practical work with this book. It provides the telephone worker with an understandable treatment of the technical aspects of his work, valuable as a key to better results and improved skill in any job he may undertake.

JUST OUT!

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1—250 HP, 600 RPM, 4000 volt, G.E., sync.
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1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
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1—150 HP, 400 RPM, 440 volt, G.E., sq. cg.
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1—100 HP, 900 RPM, 440 Westinghouse, sq. cg.
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3—100 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., slip ring.
1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.
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1— 75 HP, 900 RPM, 440 volt, G.E., sq. cg.
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1— 75 HP, 720 RPM, 440 volt, G.E., sq. cg.
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1—350 HP, 300 RPM, 440 volt, General Electric, slip ring
1—200 HP, 440 volt, 600 RPM, Crocker-Wheeler, slip ring.
1—300 HP, 720 RPM, 2200 volt, General Electric, slip ring.

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1—250 HP, 760 RPM, Electro Dynamic.
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1— 30 HP, 225/900 RPM, Crocker Wheeler.
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1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
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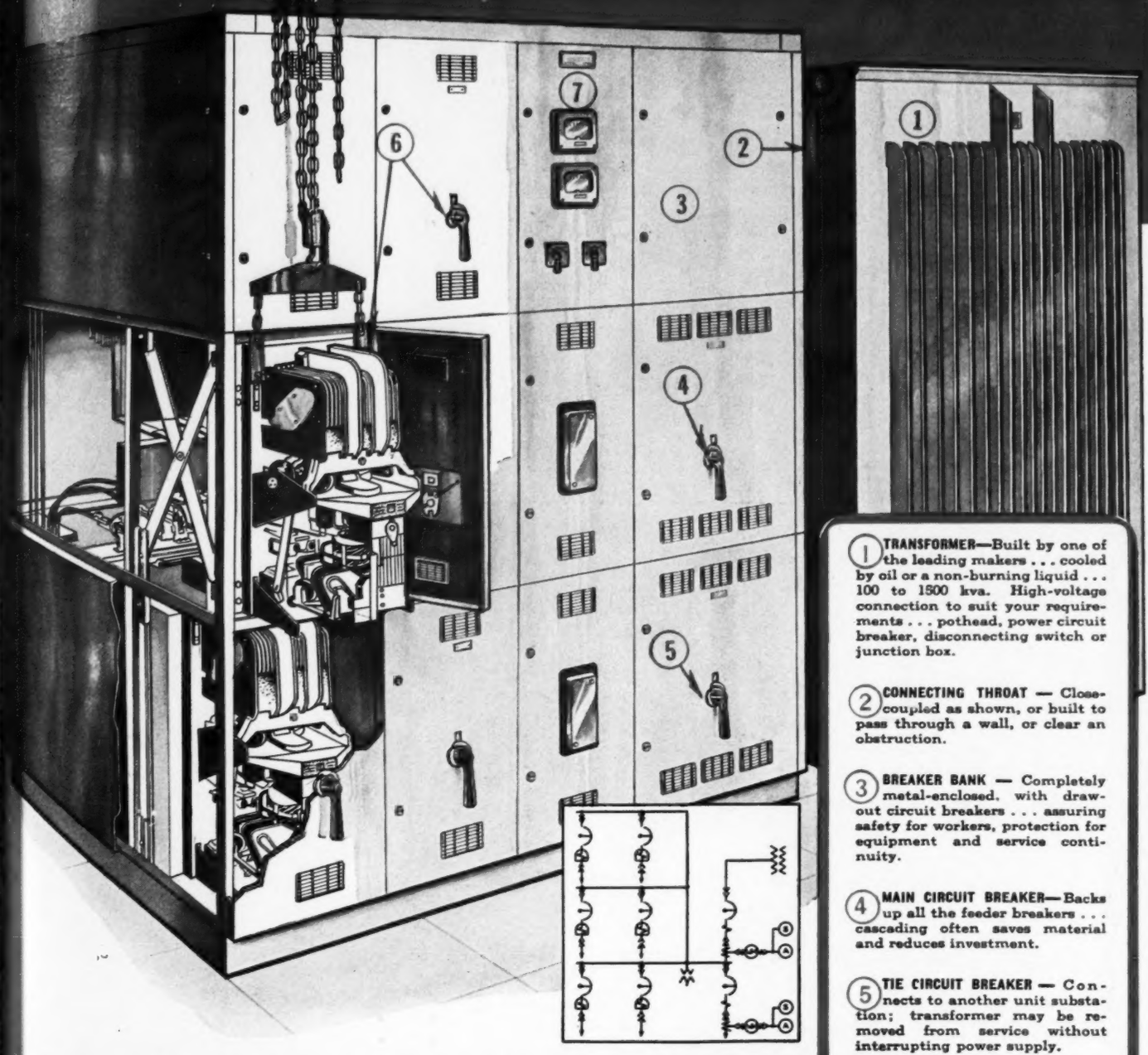
I-T-E DRAWOUT SWITCHGEAR

Features You Want in Unit Substations



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(4) **MAIN CIRCUIT BREAKER**—Backs up all the feeder breakers . . . cascading often saves material and reduces investment.

(5) **TIE CIRCUIT BREAKER** — Connects to another unit substation; transformer may be removed from service without interrupting power supply.

(6) **FEEDER CIRCUIT BREAKERS**—Drawout type . . . spare breaker may be substituted during periodic inspections.

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Advantages of Unit Substations have led to rapid adoption and will lead to much wider use—saving in cable copper, reducing voltage drop by employing short feeders, saving in space with compact arrangement of indoor transformers and breaker banks, quick installation and equally simple removal to a new location.

Design and construction of the unit are important in providing such advantages in fullest measure.

The features of design and construction identified on this page are but a few that I-T-E engineers will gladly go over with you.

Representatives in Principal Cities

I-T-E

AIR SWITCHGEAR

IMMERSED IN AIR — ENCASED IN STEEL

The Army-Navy "E" for Production Excellence

I-T-E

CIRCUIT BREAKER CO., PHILADELPHIA 30, PA.

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A phenomenon that explains why
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good for the life of the turbine.

PETROLEUM contains certain highly unstable molecules that fairly drink up the oxygen with which they come into contact. Some of these develop into asphaltenes. In turbine oil, these compounds settle out when the oil reaches the turbine's cooler parts . . . they may clog feed lines . . . they tend to form water sludge deposits.

So the asphaltene-formers are bad little molecules.

But they have their *good* points. In fact, they handle a job that *has* to be done. They retard oxidation. They include natural oxidation inhibitors. In that respect, they're *good* little molecules.

What to do with them? If asphaltene-formers would only be just all bad, or all good, they wouldn't be "problem-molecules." If all *bad*, take 'em all *out*. If all *good*, leave 'em all *in*. But here's why the refining problem can't be so easily solved: unless the oxidation inhibiting job is done, the oil soon oxidizes to form *acids*, which in turn contribute to troublesome emulsions and water sludge.

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